

PUBLISCIENCE

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Mail: The Editors-in-Chief
Publiscience
Philippine Science High School
Western Visayas Campus
Brgy Bito-on, Jaro, Iloilo City
5000 Philippines

Trunklines: *Director's Office Direct Line*
+63-33-3295644

Registrar's Office Direct Line
+63-33-3290501

+63-33-5014335
+63-33-5014133

E-mail: publiscience@wvc.pshs.edu.ph

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ABOUT THE COVER



The cover features bunker fuel on foil. Bunker fuel, which powers marine vessels, is the most common type of oil in oil spill incidents. A heavy fuel oil that evaporates only in small percentages and has a higher viscosity relative to other oil types, it is highly persistent in environments where it is not supposed to be in. Just like bunker fuel, our persistence in the most uncanny and difficult situations makes us float on top. No obstacle can easily absorb our energy to push us to giving up. Instead, we take it as a challenge to improve ourselves, becoming victors in the end.



ABOUT PSHS

MISSION

The Philippine Science High School, operating under one System of Governance and Management, provides scholarship to students with high aptitude in science and mathematics.

The PSHS System offers an education that is humanistic in spirit, global in perspective, and patriotic in orientation. It is based on a curriculum that emphasizes science and mathematics and the development of well-rounded individuals.

The PSHS System prepares its students for careers in Science and Technology and contributes to nation building by helping the country attain a critical mass of professionals and leaders in Science and Technology.

VISION

We are the leading science high school in the Asia Pacific Region preparing our scholars to become globally competitive Filipino scientists equipped with 21st century skills and imbued with the core values of truth, excellence, and service to nation.

STATEMENT

The Philippine Science High School System is a service institute of the Department of Science and Technology (DOST) whose mandate is to offer scholarship in secondary education with special emphasis on subjects pertaining to the sciences to prepare its students for a science career (R.A. 3661). Its primary function is to administer the country's scholarship program in special science secondary education.

Be a PSHS Scholar today!

RACE (Requirements for Admission, Criteria and Evaluation)

- **2-stage** selection procedure.
 1. Determining applicant's **predicted NCE grade (PNG)** based on **final grades** in Science and Mathematics in Grade 5.
 2. Writing skills test through an **essay submission** and the **applicant's academic rank** at the end of Grade 5.
- Applicants will be **ranked** based on final score.
- **Top 240** applicants – Principal Qualifiers to PSHS – MC.
- **Top 90 or 120** applicants – Principal Qualifiers to PSHS Regional Campuses (depending on quota).

Admission requirements

- Final grade of **85% or better** in Science and Mathematics
- **Filipino citizen** (with no pending applications)
- Born **on or after** August 1, 2006
- **First time** to take the DOST-PSHS National Competitive Exam
- **Satisfactory** character rating
- **Good health and fit** to handle the program

Perks of being a PSHS scholar

- Recipient of a **globally-competitive education** specializing in Science, Technology, Engineering, and Mathematics (**STEM**).
- **Science Immersion Program (SIP)** – experience working in science and technology institutions, both here and abroad.
- **SCALE** (Service, Creativity, Action, and Leadership Program) – engagement in non-STEM fields to complement intensive STEM curriculum and develop well-rounded skills.
- Chance to exhibit and hone globally-competitive skills in national and international **events / competitions**.

FOREWORD

PUBLISCIENCE is a collection of the research works of the graduating scholars of Philippine Science High School- Western Visayas Campus (PSHS-WVC). This is the final output of students by the end of their Research 3 subject. As a requirement for graduation, this year's publication is the fourth volume of at most 34 different studies in the areas of agriculture, aquaculture, computer science, environmental science and health, materials science and technology, microbiology and biochemistry, and spatial analysis. PSHSWVC takes pride to be the very first and still is the only PSHS Campus that has successfully published all the Science and Technology Research works of its graduating scholars. This legacy is continued through the hard work of our scholars with support and guidance from our Research Unit. Publiscience is a testament of our scholars' pursuit for excellence. Congratulations to our Research Unit and our Batch 2021!

SHENA FAITH M. GANELA

Campus Director III

* * *

Congratulations Batch 2021 in your Publiscience! Researches are not meant to be kept and displayed in the bookshelves and gather clouds of dust rather it has to be shared with the academic community through publications. The publication of your research works is a sterling example of what every researcher must achieve. Indeed, accomplishing this gigantic task requires more than just material resources but also loads of patience, dedication and determination.

Amidst all the challenges, you have taught yourself the most valuable lesson in life and that is to bring out the best version of yourself in accomplishing any task, overcoming difficulties and finding solutions to problems.

My heart is filled with pride and happiness because you are now, more than ever equipped and ready to accomplish bigger tasks, overcome more obstacles and find solutions to bigger problems.

May your experiences give you wisdom, may your passion burn bright and move you to learn more and do more, and may your efforts be rewarded all for the glory of God and for your country.

Congratulations. Ingat lagi.

ROLANDO S. LIBUTAQUE

Curriculum Instruction Division Chief

* * *

THE RESEARCH PROGRAM

The research program is a three-year undertaking that aims to inculcate the scholars with the quality and skills becoming of a world-class Filipino scientist. Each year starting from Grade 10 focuses on an aspect of research paramount to the growth of scholars in becoming leading figures in their respective fields.

RESEARCH 1

Research as a subject is introduced in Grade 10. It is the formative year for the budding researcher with in-depth discussions on the Scientific Method, and the Research Process. Particularly, it introduces scholars in topic selection, literature search, research design, and paper presentation. Scholars were also taught the basics of writing a proposal, and a research paper – both in instruction, and in practice. Each group or work unit is composed of at most five members with general topics provided by the Research 1 teachers. Research 1 culminates with the paper presentation of the Grade 10 scholars in *Pagsuguidadon*.

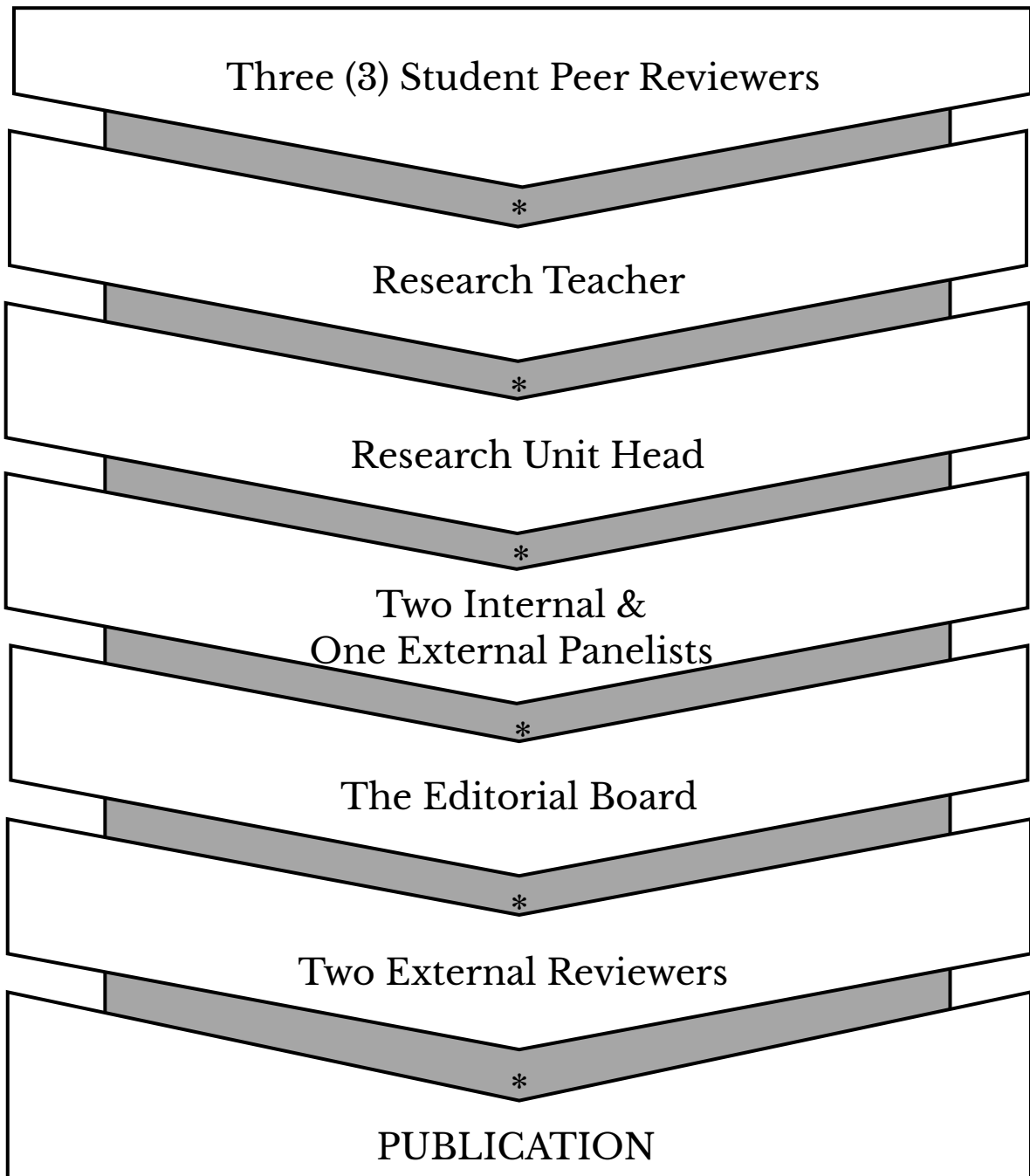
RESEARCH 2

Research 2 is the reinforcement year in Grade 11. The writing of the proposal, and the research paper are further scrutinized in this year. Each section of a standard research paper: abstract, introduction, method, results, discussion, and conclusion are more pronounced in the syllabus. Research 2 is performed in work units of, at most, three. Scholars are allowed to select any topic in alignment with their science options and/or elective under the supervision of their advisers, propose and defend their proposal to a panel, develop and/or enhance skills related to the study, perform the method outlined in their proposal, and report their findings in a full-fledged research paper. Research 2 concludes with the presentation of the results in the final defense.

RESEARCH 3

Research 3 is the culminating year of the research curriculum. It is reserved for Grade 12 scholars who organize activities and events that share their respective study's findings, including but not limited to: research presentation (*Pagbantala*), poster presentation (*Pagbalandra*), seminar-workshop (*Pahisayod*), and community science conference (*Pagwaragwag*) with more events described at the end of this journal. This very journal is a fruit of the previous two batches' research experience. Research 3 focuses on finalizing the study and networking the results. It focuses on community-oriented approach in making science more accessible. This is evident in the oral and poster presentations for students and professionals, workshops and seminars for high school students, and gamification of each study for elementary students during the aforementioned events. Each study is given the opportunity to be published in this journal, provided that they have accomplished the review process outlined at the left.

The Research Review Process



***Research Adviser**

Since research advisers are the co-authors of the journal article, they need to be updated with or review the article after each change.

THE RESEARCH COMMITTEE

The Research Committee is tasked with ensuring the quality of all research projects produced by the Batch 2021 scholars, performed from the 10th to the 12th grade. It is headed by the Research Unit Head who oversees and approves all research work and composed of the research teachers who handle the Research class for a specific school year and grade level and the research advisers who provide guidance, insight, and assistance in a consulting capacity in their fields of expertise. The Science Research Assistants (SRA) manage the different labs, apparatuses, equipment, and reagents for the use of the scholars in the conduct of their respective studies.

* * *

RESEARCH UNIT HEAD

Aris C. Larroder

RESEARCH 3 TEACHERS SY 2020–2021

Aris C. Larroder

Catherine Joy A. Mediodia

Ramon Angelo N. Sinco

RESEARCH 2 TEACHERS SY 2019–2020

Athenes Joy Presno-Aban

Julnafe B. Libo-on

Zennifer L. Oberio

RESEARCH 1 TEACHERS SY 2018–2019

Mialo P. Bautista

Harold P. Mediodia

Lovie Grace A. Nzeakor

RESEARCH ADVISERS

BIOLOGICAL SCIENCES & MICROBIOLOGY

Andrea Lucyle M. Bela-ong

Maria Deanna Jolito

Fernando Christian G. Jolito III

Julnafe B. Libo-on

Catherine Joy A. Mediodia

Harold P. Mediodia

Virna Jane M. Navarro

Angelo P. Olvido

Zennifer Oberio

CHEMISTRY & INTEGRATED SCIENCE

Michael Patrick M. Padernal

Ramon Angelo N. Sinco

PHYSICS & ENGINEERING

David Bryan P. Lao

Aris C. Larroder

Xavier Romy Braña

COMPUTER SCIENCE & TECHNOLOGY

Eisen Ed C. Briones

Maria Milagrosa A. Nulla

Gerald U. Salazar

STATISTICS TEACHERS

Charmaine D. Aguirre

Ma. Romy Alexis C. Consulta

Myrna B. Libutaque

SCIENCE RESEARCH ASSISTANT (SRA)

CHEMISTRY

Leilani C. Estilo

INSTRUMENTATION

Mark V. Rosales
Amafe B. Gavile

MICROBIOLOGY

Rusty A. Balcoba
Cherry Rose D. Haro

PHYSICS

Gabriel Z. Bermejo
Rusty A. Balcoba

REVIEWERS AND PANELISTS

The research curriculum of PSHS - WVC is predominantly composed of highly immersive activities that develop the scholars' skills as researchers and scientific communicators. From Grade 10, the scholars experience the rigors of having to defend their proposals and, ultimately, their final paper.

PAGSUGUIDADON

PAGSUGUIDADON, from the Hiligaynon word *suguid* or "to report", is the culminating event for the Grade 10 Research curriculum. Scholars present and defend their paper to a three-person panel, composed of two invited panelists and a faculty member of PSHS-WVC. The papers are presented in five clusters with each study's overarching theme as the basis of grouping.

INVITED PANELISTS

Hannah Valencia
UNIVERSITY OF SAN AGUSTIN

Emily Singbenco
ASSUMPTION ILOILO

Paolo Cabañero
WESTERN INSTITUTE OF TECHNOLOGY

Ardee Caro
DEPARTMENT OF EDUCATION – BAROTAC
NUEVO

May Sansait
ILOILO SCIENCE AND TECHNOLOGY UNIVERSITY

Homer Gumban
ALEJANDRO FIRMEZA MEMORIAL NATIONAL
HIGH SCHOOL

Mathew Tubola
UNIVERSITY OF SAN AGUSTIN

Micah Lojera
SOUTHEAST ASIAN FISHERIES DEVELOPMENT
CENTER

Early Sol Gadong
UNIVERSITY OF THE PHILIPPINES - VISAYAS

Sarah Liezl Lacaden
FREELANCE PROGRAMMER

PSHS-WV FACULTY

Ramon Angelo Sinco
SESSION 1

Catherine Joy Mediodia
SESSION 2

Andrea Lucyle Bela-ong
SESSION 3

Angelo Olvido
SESSION 4

David Bryan Lao
SESSION 5

PAGBANTALA

PAGBANTALA, from the Hiligaynon word *bantala* or “to inform”, is the oral presentation of the scholars’ studies to a panel of experts composed of an invited panelist, an alumni, and a faculty member of PSHS - WVC. For the SY 2020-2021, the studies were presented in 7 clusters namely: Aquaculture, Agriculture, Plant Chemistry, Satellite Imagery, a combination of categories (Agriculture, Aquaculture, and Satellite Imagery), and Computer Science and Technology (ordered below left to right, top to bottom).

INVITED PANELISTS

Peter Palma
SOUTHEAST ASIAN FISHERIES DEVELOPMENT
CENTER

Irene R. Betalas
UNIVERSITY OF THE PHILIPPINES - VISAYAS

Phillip Raymund R. De Oca
BACOLOD CITY NATIONAL HIGH SCHOOL

Carlo Chris Apurillo
PHILIPPINE SCIENCE HIGH SCHOOL - EASTERN
VISAYAS CAMPUS

Evans Sansolis
WEST VISAYAS STATE UNIVERSITY

Raphael Kevin Nagal
DEPARTMENT OF EDUCATION - DIVISION OF
AKLAN

Mary Sol Baldevarrona
ILOILO STATE COLLEGE OF FISHERIES

PSHS-WV ALUMNI

Micah Lojera
SOUTHEAST ASIAN FISHERIES DEVELOPMENT
CENTER

Rhyll Joy Balinas
PSHS-WVC BATCH 2015

Neil Phillip Poral
PSHS-WVC BATCH 2014

Jobi Subosa
NATIONAL INSTITUTE OF MOLECULAR BIOLOGY
AND BIOTECHNOLOGY

John Dale Dianala
UNIVERSITY OF THE PHILIPPINES - DILIMAN

Gregory Parcon
ADVANCED WORLD SOLUTIONS INC.

Vincent Errick Itucal
CHI-X GLOBAL TECHNOLOGY (PHILIPPINES) INC.

PSHS-WVC FACULTY

Virna Navarro
AQUACULTURE

Angelo Olvido
AGRICULTURE

Erika Eunice P. Salvador
PLANT CHEMISTRY

Ma. Deanna Jolito
MICROBIOLOGY AND ENVIRONMENTAL SCIENCE

David Bryan Lao
SATELLITE IMAGERY

Andrea Lucyle Bela-ong
AGRICULTURE, AQUACULTURE, AND SATELLITE
IMAGERY

Gerald Salazar
COMPUTER SCIENCE AND TECHNOLOGY

THE FINAL DEFENSE

The **FINAL DEFENSE** is the final step towards the end of the research curriculum. The scholars invite one external expert and two PSHS - WVC faculty to compose a three-person panel to assess the merits and validity of their findings. The final defense panel recommends revisions to the study's manuscript as well as continually review the same until approval.

INVITED PANELISTS

Ariel Blanco

Ian Kendrick Fontanilla
UNIVERSITY OF THE PHILIPPINES – DILIMAN

Jeark Principe

Michael Russelle Alvarez

Rowena Carpio
UNIVERSITY OF THE PHILIPPINES – LOS BAÑOS

Milagrosa Martinez - Goss

Teodora Bagarinao

SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

Peter Palma

Melissa June Paderog - Ariego
UNIVERSITY OF SAN AGUSTIN

Corazon Arroyo
DEPARMENT OF AGRICULTURE –
REGION VI

Mary Jane Calagui
CAGAYAN STATE UNIVERSITY

Gabrielle Troy Cuevas
UNIVERSITY OF THE PHILIPPINES
– VISAYAS

Grace delos Reyes
AKLAN CATHOLIC COLLEGE

Gerard Dumancas
LOUISIANA STATE UNIVERSITY –
ALEXANDRIA

Anthony Joseph Lucero
DEPARTMENT OF SCIENCE AND
TECHNOLOGY - PAGASA

John Jowil Orquia
UNIVERSITY OF ANTIQUE

Edsel Peña
UNIVERSITY OF SOUTH
CAROLINA

Stephen Sabinay
WEST VISAYAS STATE
UNIVERSITY

Jerson Sala
5TH DISTRICT PROVINCE OF
ILOILO

Julie Ann Acebuque Salido
AKLAN STATE UNIVERSITY

Cristie Sumbilla
NEW LUCENA NATIONAL
COMPREHENSIVE HIGH SCHOOL

Isabelle Tingzon
THINKING MACHINES

PSHS-WVC FACULTY

Fernando Christian Jolito III
Catherine Joy Mediodia

Ma. Deanna Jolito
Virna Jane Navarro
BIOLOGICAL SCIENCES UNIT

Julnafe Libo-on
Angelo Olvido

Athenes Joy Presno-Aban
Erika Eunice Salvador

Michael Patrick Padernal
CHEMISTRY AND INTEGRATED SCIENCES UNIT

Elizalde Miguel Flores
Ramon Angelo Sinco

Raphael Eric Yturralde

Xavier Romy Braña
Aris Larroder
PHYSICAL SCIENCES UNIT

Oliver Fuentespina

Eisen Ed Briones

Jose Vicente Tan
COMPUTER SCIENCE AND TECHNOLOGY UNIT

Maria Millagrosa Nulla

David Bryan Lao
Zennifer Oberio
MATHEMATICS UNIT

THE EXTERNAL REVIEWERS

THE EXTERNAL REVIEWERS are practitioners of scientific fields recommended by the Research Unit and invited by the Editorial Board to assess the merit and substance of each of the published papers. These individuals serve as the final reviewers prior to an article's publication. Before the publication of this section, their identities are anonymous to the authors.

Bee Gee Belle Agustin
AKLAN STATE UNIVERSITY, PHL

Aldrean Paul Alogon
WESLEYAN UNIVERSITY, USA

John Rafael Ambag
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Artoni Kevin Ang
NAGOYA INSTITUTE OF
TECHNOLOGY, JPN

**Christine Marie Angos-
Banaszek**
CHARLES ROSS & SON COMPANY,
USA

Romie Angelo Azur
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Jenny Babon
HARVARD UNIVERSITY, USA

Justin Enrique Banusing
UNIVERSITY OF WASHINGTON,
USA

**Juan Paolo
Lorenzo Gerardo Barrios**
DURHAM UNIVERSITY, GBR

Diana Mae Calde
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Alexis Richard Claridades
UNIVERSITY OF SEOUL, KOR

Myke Wallace Cohen
ARIZONA STATE UNIVERSITY,
USA

Marlon Conato
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Cris Jericho Cruz
KOREA ADVANCED
INSTITUTE OF SCIENCE, KOR

Roldan De Guia
INSTITUTE OF MOLECULAR
GENETICS, CZE

Christian Deo Deguit
UNIVERSITY OF THE
PHILIPPINES - MANILA, PHL

Ina Dela Fuente
UNIVERSITY OF CONNECTICUT,
USA

Yevgeny Aster Dulla
INTRALINK JAPAN, JPN

Emil Emmanuel Estilo
HIROSHIMA UNIVERSITY, JPN

Philip Caesar Flores
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Riel Carlo Ingeniero
GEOMER HELMHOLTZ CENTRE
FOR OCEAN RESEARCH, DEU

Angelo Jamerlan
GACHON UNIVERSITY, KOR

Ma. Christina Jamerlan
NEURAL MECHANICS INC., PHL

Santiago Emil A. Joson IV
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Sami Juanico
UNIVERSITY OF THE PHILIPPINES
VISAYAS FOUNDATION INC., PHL

Chricel Lattao
UNIVERSITY OF SANTO TOMAS,
PHL

Joseph Simon Madrinan
PHILIPPINE SCIENCE HIGH
SCHOOL - WESTERN VISAYAS,
PHL

Ellazar Niangar
GENERAL MOTORS GLOBAL
FUEL CELL ACTIVITIES, USA

Lurylee Olarte
PANAY ENERGY DEVELOPMENT
CORPORATION, PHL

Jacqueline Ponteres
ASPEN TECHNOLOGY AUSTRALIA
PTY LTD, AUS

Marmelou Popes
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Ben Joshua Porras
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Peter Paolo Rivera
UNIVERSITY OF EAST ANGLIA,
GBR

Leo Albert Sala
J. HEYROVSKY INSTITUTE OF
PHYSICAL CHEMISTRY, CZE

Jaya Lavalie Sitjar
NATIONAL CHENG KUNG
UNIVERSITY, TWN

Alexandria Sombiro
UNIVERSITY OF THE
PHILIPPINES - DILIMAN, PHL

Varsolo Sunio
YONDU, INC., PHL

Liezel Tamon
MRC WETHERALL INSTITUTE OF
MOLECULAR MEDICINE, GBR

John Noel Viaña
AUSTRALIAN NATIONAL CENTRE,
AUS

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Research Events: *Pagwaragwag, Paindis-indis, Pagpabalhag, Pagsuguidadon*

Keyword Index

Institutional Partners

PREFACE

It is our pleasure to present the fourth volume of Publiscience, the annual, peer-reviewed research journal of PSHS-WVC. Publiscience is a joint effort of the scholars and the Research Unit to communicate the results of the scholars' studies. In line with the PSHS mission and vision, the publication cultivates their research skills in preparation for them to become world-class Filipino scientists. Since the establishment of the journal in 2018, the scholars have strived to innovate and improve the aspects of the journal. For this volume, the *Pagpasanyog* or the improvement entails transparency on the conduct of the studies, by providing readers open-view access to supplementary data supporting the results and including the submission, approval, and publication dates of the articles.

The fourth volume of Publiscience contains 20 Science and Technology (S&T) studies venturing into topics such as Biology, Chemistry, and Engineering. The journal articles are clustered into seven (7) areas, namely: (1) Environmental Science and Health, (2) Material Science and Technology, (3) Microbiology and Biochemistry, (4) Agriculture, (5) Aquaculture, (6) Computer Science, and (7) Spatial Analysis.

Lastly, this volume was published during a period of great hardship and uncertainty. Essentially, it has considerably affected the conduct of research studies—the greatest obstacle in the research process. Despite the odds, the PSHS-WVC scholars persevered to publish the research articles, all in the pursuit of truth, passion for excellence, and commitment to service. This serves as our testament that research can be conducted during unfavorable circumstances. The pandemic has indeed highlighted the significance of research in society, and it is and will always be the advocacy of Publiscience to promote the pursuance of research to be of service to the people.

THE EDITORIAL BOARD

* * *

DEDICATION

This journal is dedicated to all the learners and teachers,
who struggled during these difficult times yet study and teach
to satisfy the thirst for knowledge and love for learning and the DOST Secretary,
Fortunato de la Peña, for spearheading the scientific efforts in dealing with the pandemic.