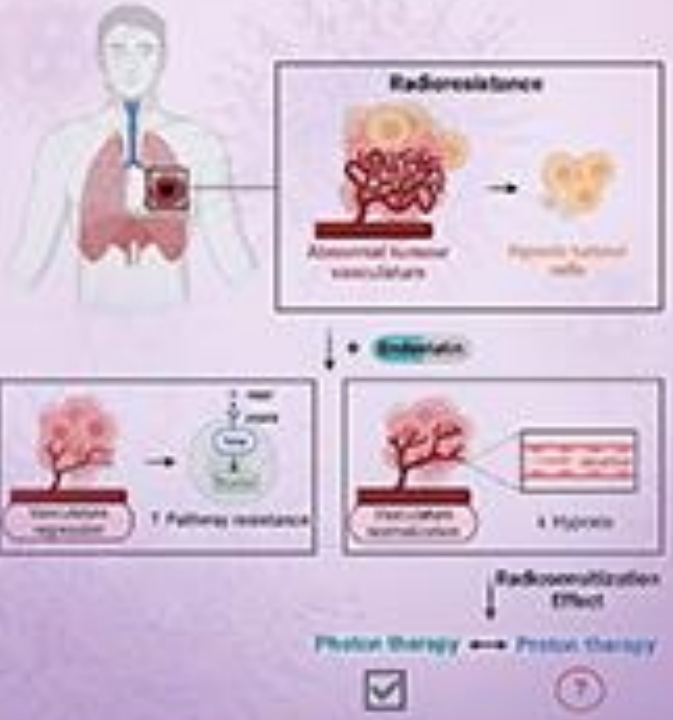
pharmaceuticals

IMPACT FACTOR 5.215

Indexed in PubMed



Endostatin as a Radiosensitizer in the Treatment of Non-Small Cell Lung Cancer

Volume 16 · Issue 2 | February 2023

MDPI

mdpi.com/journal/pharmaceuticals
ISSN 1424-8247

Affiliated Society:

(https://serve.mdpi.com/www/my_files/cliiik.php?oaparams=0bannerid=7061zoneid=4cb=b8b

Editorial Board

- Medicinal Chemistry Section (/journal/pharmaceuticals/sectioneditors/pharm_medicinal_chemistry)
- Biopharmaceuticals Section (/journal/pharmaceuticals/sectioneditors/biopharmaceuticals)
- Natural Products Section (/journal/pharmaceuticals/sectioneditors/natural_products)
- Radiopharmaceutical Sciences Section (/journal/pharmaceuticals/sectioneditors/radiopharmaceutical_sciences)
- Pharmacology Section (/journal/pharmaceuticals/sectioneditors/pharm-pharmacology)
- Pharmaceutical Technology Section (/journal/pharmaceuticals/sectioneditors/pharmaceutical_technology)

Members (178)

Search by first name, last name, affiliation,

Prof. Dr. Amélia Pilar Rauter (https://sciprofiles.com/profile/266604)
Website (https://webpages.ciencias.ulisboa.pt/~aprauter/)
Editor-in-Chief
Departamento de Química e Bioquímica, Centro de Química e Bioquímica (CQB), Faculdade de Ciências, Universidade de Lisboa (FCUL), Rua Ernesto de Vasconcelos, Edifício C8, 5º Piso, 1749-016 Lisboa, Portugal
Interests: carbohydrate small molecule synthesis; organic and biomolecular chemistry developments towards new therapeutic approaches for diabetes; Alzheimer's disease and other amyloid diseases and carbohydrate-based antibiotics
Special Issues, Collections and Topics in MDPI journals

Dr. Maria Emília De Sousa (https://sciprofiles.com/profile/148085)
Website (https://sigarra.up.pt/ffup/pt/func_geral.formview?p_codigo=373844)
Associate Editor
1. Interdisciplinary Centre of Marine and Environmental Research (CIIMAR), 4450-208 Porto, Portugal
2. Laboratory of Organic and Pharmaceutical Chemistry, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal
Interests: medicinal chemistry; organic synthesis; drug discovery; heterocycles; P-glycoprotein; anticancer; antimicrobial; chiral drugs; marine natural products
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Thomas Efferth (https://sciprofiles.com/profile/9530)
Website (https://www.cinema.uni-mainz.de/prof-dr-thomas-efferth/)
Associate Editor
Department of Pharmaceutical Biology, Institute of Pharmaceutical and Biomedical Sciences, Johannes Gutenberg University, Staudinger Weg 5, 55128 Mainz, Germany
Interests: natural products; molecular pharmacology; cancer; drug resistance; genome-wide profiling
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Joachim Jose (https://sciprofiles.com/profile/123628)
Website (https://www.uni-muenster.de/Chemie.pz/forschen/ag/jose/index.html)
Associate Editor
PharmaCampus Institute of Pharmaceutical and Medicinal Chemistry, Westfälische Wilhelms-Universität, Corrensstr. 48, 48149 Muenster, Germany
Interests: autodisplay; assay development and inhibitor testing; whole cell biocatalysts for synthesis of drugs and building blocks; directed evolution of enzyme inhibitors and biocatalysts; biosensor development and diagnostic tools
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Klaus Kopka (https://sciprofiles.com/profile/907163)
Website (https://www.hzdr.de/db/Cms?pNid=130)
Associate Editor
Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Institute of Radiopharmaceutical Cancer Research, 01328 Dresden, Germany
Interests: radiopharmaceutical drug development; radiopharmaceutical sciences; medicinal radiochemistry; radionuclide theranostics; targeted endoradiotherapy; noninvasive molecular imaging; PET; SPECT
Special Issues, Collections and Topics in MDPI journals

Dr. Chen Ling (https://sciprofiles.com/profile/962574)
Website (https://life.fudan.edu.cn/66/cb/c31279a353995/page.htm)
Associate Editor
State Key Laboratory of Genetic Engineering and Engineering Research Center of Gene Technology (Ministry of Education), School of Life Sciences, Zhongshan Hospital, Fudan University, Shanghai 200438, China

Interests: cancer therapeutics; mRNA translation; gene therapy; virology
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Guangshun Wang (https://sciprofiles.com/profile/47472)
Website (https://www.unmc.edu/pathology/faculty/bios/wang.html)
Associate Editor
Department of Pathology & Microbiology, University of Nebraska Medical Center, Omaha, NE 68198-5900, USA
Interests: host defense antimicrobial peptides; structural bioinformatics; biomolecular NMR
Special Issues, Collections and Topics in MDPI journals

Dr. Alfredo Berzal-Herranz (https://sciprofiles.com/profile/19235)
Website (https://www.ipb.csic.es/departamentos/aberzalh_ingles.html?depto=MolecularBiologyDepartment)
Section Editor-in-Chief
Department of Molecular Biology, Instituto de Parasitología y Biomedicina López-Neyra, (IPBLN-CSIC), PTS Granada, Av del Conocimiento 17, 18016 Granada, Spain
Interests: antiviral nucleic acids; therapeutic RNA; aptamers; RNA inhibitors; structure/function of RNA; RNA viruses
Special Issues, Collections and Topics in MDPI journals

Dr. Daniela De Vita (https://sciprofiles.com/profile/924933)
Website (https://phd.uniroma1.it/web/DE-VITA-DANIELA_nC2550.aspx)
Section Editor-in-Chief
Department of Environmental Biology, Sapienza University of Rome, Rome, Italy
Interests: medicinal plants; alkaloids; phytochemistry; HPLC; LC-MS; antiviral agents; antifungal agents; anticancer agents; Alzheimer's disease; cholinesterases
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Gill Diamond (https://sciprofiles.com/profile/66473)
Website (https://louisville.edu/dentistry/departments/oralhealth/faculty/gill-diamond-phd)
Section Editor-in-Chief
Department of Oral Immunology and Infectious Diseases, University of Louisville School of Dentistry, Louisville, KY 40292, USA
Interests: regulation of innate immunity; antimicrobial peptides; antifungal peptides; defensins; cathelicidins; novel antiviral compounds
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Mary J. Meegan (https://sciprofiles.com/profile/162157)
Website (https://people.tcd.ie/Profile?Username=mmeegan)
Section Editor-in-Chief
Trinity Biomedical Sciences Institute, School of Pharmacy and Pharmaceutical Sciences, Trinity College Dublin, 152−160 Pearse Street, Dublin 2 D02 R590, Ireland
Interests: anticancer drug design; breast cancer; novel antioestrogens; tubulin targeting agents; azetidinones; antioestrogen–drug conjugates;

oestrogen receptor; Burkitt's lymphoma; chronic lymphocytic leukaemia

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Serge Mordon (https://sciprofiles.com/profile/583847)

Website1 (http://www.biotis-bordeaux.com/) **Website2 (http://www.oncothai.fr/)**

Section Editor-in-Chief

INSERM (French National Institute of Health and Medical Research) U1026, The Laboratory of the Bioengineering of Tissues (BioTis), University of Bordeaux, 146 rue Léo Saignat, 33076 Bordeaux, France

Interests: photodynamic therapy; cancer; clinical evaluation; photosensitizer; dosimetry; fluorescencer; Dosimetry; fluorescence

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Gary J. Stephens (https://sciprofiles.com/profile/43946)

Website (https://www.reading.ac.uk/pharmacy/staff/professor-gary-stephens)

Section Editor-in-Chief

School of Pharmacy, University of Reading, Whiteknights, Reading RG6 6AJ, UK

Interests: electrophysiology; voltage-gated calcium channels; cannabinoids; ion channels; GPCRs; pain; ataxia

Special Issues, Collections and Topics in MDPI journals

Dr. Irina Velikyan (https://sciprofiles.com/profile/113591)

Website (https://katalog.uu.se/profile/?id=N1-184)

Section Editor-in-Chief

Department of Surgical Science, Uppsala University, 751 85 Uppsala, Sweden

Interests: nuclear medicine; radiochemistry; positron emission tomography; molecular imaging; radiopharmaceutical sciences; cancer; diabetes; fibrosis; drug development; inflammation

Special Issues, Collections and Topics in MDPI journals

Dr. Annie Mayence (https://sciprofiles.com/profile/468756)

Website (https://orcid.org/0000-0003-2509-7593)

Advisory Board Member

Formerly professor at the Haute Ecole Provinciale de Hainaut-Condorcet, 7330 Saint-Ghislain, Belgium

Interests: medicinal chemistry; organic synthesis; parasitic diseases; orphan drugs

Special Issues, Collections and Topics in MDPI journals

Dr. Jean Jacques Vanden Eynde (https://sciprofiles.com/profile/93338)

Website1 (https://orcid.org/0000-0003-4770-4104) **Website2 (https://publons.com/researcher/1447855/jean-jacques-vanden-eynde)**

Advisory Board Member

Formerly Head of the Department of Organic Chemistry (FS), University of Mons-UMONS, 7000 Mons, Belgium

Interests: heterocycles; medicinal chemistry; green chemistry; microwave-induced synthesis

Special Issues, Collections and Topics in MDPI journals

Dr. Alessandra Ammazzalorso (https://sciprofiles.com/profile/612587)
Website (https://www.unich.it/ugov/person/624)
Editorial Board Member
Department of Pharmacy, “G. d’Annunzio” University of Chieti-Pescara, Chieti, Italy
Interests: medicinal chemistry; drug discovery; aromatase inhibitors; PPAR ligands; anticancer agents
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Paolo Arosio (https://sciprofiles.com/profile/149345)
Website (https://www.researchgate.net/profile/Paolo_Arosio)
Editorial Board Member
Department of Molecular and Translational Medicine, University of Brescia, 25123 Brescia, Italy
Interests: iron metabolism; ferritin; iron storage
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Anna Artese (https://sciprofiles.com/profile/27411)
Website (https://dss.unicz.it/personale/docente/annaartese)
Editorial Board Member
Dipartimento di Scienze della Salute, Università “Magna Graecia” di Catanzaro, Campus “Salvatore Venuta”, Viale Europa, 88100 Catanzaro, Italy
Interests: drug design; molecular modeling; molecular dynamics; virtual screening; pharmacophore modeling; drug repurposing; natural products
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Atanas G. Atanasov (https://sciprofiles.com/profile/1611726)
★ **(https://recognition.webofscience.com/awards/highly-cited/2021/)** **Website (https://digitalpatientsafety.com/atanas-g-atanasov/)**
Editorial Board Member
1. Ludwig Boltzmann Institute for Digital Health and Patient Safety, Medical University of Vienna, Spitalgasse 23, 1090 Vienna, Austria
2. Institute of Genetics and Animal Biotechnology of the Polish Academy of Sciences, Jastrzebiec, 05-552 Magdalenka, Poland
Interests: molecular medicine; biotechnology; digital health; open innovation; natural products
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Jong-Sup Bae (https://sciprofiles.com/profile/845300)
Website (https://pharmacye.knu.ac.kr/)
Editorial Board Member
College of Pharmacy, Kyungpook National University, Daegu, Korea
Interests: molecular biology; cell biology; natural products

Dr. Nektarios Barabutis (https://sciprofiles.com/profile/867285)
Website (https://webservices.ulm.edu/facultyactivities/profile/barabutis)
Editorial Board Member

College of Pharmacy, University of Louisiana at Monroe, Monroe, LA 71201, USA
Interests: pathophysiology of acute lung injury and acute respiratory distress syndrome; P53 in the lung endothelium; unfolded protein response in the regulation of endothelial permeability; endoplasmic reticulum stress in the context of the lung microvasculature; heat shock proteins; extra hypothalamic effects of growth hormone-releasing hormone; endocrine-related cancer; reactive oxygen species; vascular biology
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Jean-Pierre Bazureau (https://sciprofiles.com/profile/14544)
Website (https://iscr.univ-rennes1.fr/jean-pierre-bazureau)
Editorial Board Member
Institut des Sciences Chimiques de Rennes (ISCR), UMR CNRS 6226, Groupe CORINT, Université de Rennes 1 (UR1), Campus de Beaulieu, Bât. 10A, 263 Avesnue du Général Leclerc, CS 74205, 35042 Rennes CEDEX, France
Interests: microwave-assisted organic chemistry and scale-up; “Store Operated Calcium Entry” inhibitors (Orai1) for cancer via Délikine program inhibitors; mitochondrial ion channel inhibitors for cancer; protein kinase (PKs) inhibitors for CNS (Alzheimer’s disease and Down syndrome) via Leucettine program inhibitors; fluorescence probes for studies of molecular mechanisms in cancer biology
Special Issues, Collections and Topics in MDPI journals

Dr. Martina Benešová (https://sciprofiles.com/profile/720157)
Website (https://www.dkfz.de/en/molekularbiologie-systemischer-radiotherapie/index.php)
Editorial Board Member
Research Group Molecular Biology of Systemic Radiotherapy, Research Program Imaging and Radiooncology, German Cancer Research Center (DKFZ), Im Neuenheimer Feld 223, D-69120 Heidelberg, Germany
Interests: theranostic radioligands; targeted radionuclide therapies; targeted alpha therapies; combination therapies; molecular imaging; pharmaceutical radiochemistry; coordination and bioinorganic chemistry; radionuclide production and separation methods
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Thierry Besson (https://sciprofiles.com/profile/84052)
Website (https://www.researchgate.net/profile/Thierry-Besson)
Editorial Board Member
Normandie Univ, UNIROUEN, INSA Rouen, CNRS, COBRA UMR 6014, F-76000 Rouen, France
Interests: chemistry of heterocyclic compounds; microwave-assisted chemistry; sustainable methodologies; green chemistry applied to bioactive compounds: kinase inhibitors; Alzheimer's disease; Down syndrome; cancer
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Giuseppe Biagini (https://sciprofiles.com/profile/258520)
Website (http://personale.unimore.it/rubrica/dettaglio/gbiagini)
Editorial Board Member
Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia, 41100 Modena, Italy
Interests: animal ethics; animal welfare; epilepsy models; neuroprotection; stress management
Special Issues, Collections and Topics in MDPI journals

Dr. Francesco Bifari (https://sciprofiles.com/profile/1253754)
Website (https://www.unimi.it/en/ugov/person/francesco-bifari)
Editorial Board Member
Laboratory of Cell Metabolism and Regenerative Medicine, Department of Medical Biotechnology and Translational Medicine, University of Milan, 20122 Milan, Italy
Interests: mmune suppression; embryonic stem cells; mesenchymal stem cells; immunogenicity; regenerative medicine; neural stem cells

Dr. Conor R. Caffrey (https://sciprofiles.com/profile/174040)
Website (https://pharmacy.ucsd.edu/faculty/bios/caffrey.shtml)
Editorial Board Member
Center for Discovery and Innovation in Parasitic Diseases, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA
Interests: small molecule drug discovery for parasitic protozoa and helminths; 'neglected' tropical diseases; high-throughput and high content screening; proteolysis

Prof. Dr. Ana C. Calpena (https://sciprofiles.com/profile/333616)
Website (https://www.researchgate.net/profile/Ana-Calpena)
Editorial Board Member
Department of Pharmacy and Pharmaceutical Technology and Physical Chemistry, Faculty of Pharmacy and Food Sciences, University of Barcelona, 08028 Barcelona, Spain
Interests: drug delivery; trasdermal route; pharmokinetics; biopharmaceutics
Special Issues, Collections and Topics in MDPI journals

Dr. Anna Carbone (https://sciprofiles.com/profile/2469203)
Website (https://rubrica.unige.it/personale/UkJBXVJs)
Editorial Board Member
Department of Pharmacy, University of Genoa, Viale Benedetto XV 3, 16132 Genoa, Italy
Interests: medicinal chemistry; drug discovery; small molecules; antitumor agents; kinase inhibitors; synthetic lethality
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Daniela Catarzi (https://sciprofiles.com/profile/466316)
Website (https://www.unifi.it/p-doc2-2016-0-A-2b333a293a27-1.html)
Editorial Board Member
Department of Neuroscience, Psychology, Drug Research and Child Health (NEUROFARBA), Section of Pharmaceutical and Nutraceutical Sciences, University of Florence, Via Ugo Schiff, 6, 50019 Sesto Fiorentino, FI, Italy
Interests: medicinal chemistry; rational drug design; heterocyclic compounds; structure–activity relationships; adenosine receptor ligands; carbonic anhydrase inhibitors; protein kinase CK1 and CK2 inhibitors; ecto-5'-nucleotidase (CD73) inhibitors
Special Issues, Collections and Topics in MDPI journals

Dr. Raffaella Chiaramonte (https://sciprofiles.com/profile/654244)
Website (https://www.unimi.it/en/ugov/person/raffaella-chiaramonte)
Editorial Board Member

Department of Health Sciences, Università degli Studi di Milano, 20142 Milano, Italy
Interests: notch pathway; signal transduction, cancer cell biology; tumor microenvironment; extracellular vesicles.

Dr. Elena Cichero (https://sciprofiles.com/profile/621511)
Website (https://rubrica.unige.it/personale/UkNGWV9p)
Editorial Board Member
Department of Pharmacy, University of Genoa, Viale Benedetto XV, 16132 Genoa, Italy
Interests: virtual screening; medicinal chemistry; molecular modeling; QSAR; molecular docking; GPCR; cystic fibrosis; enzymes
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Vittoria Colotta (https://sciprofiles.com/profile/466315)
Website (https://www.unifi.it/p-doc2-2017-0-A-2b323c31382b-0.html)
Editorial Board Member
Department of Neuroscience, Psychology, Drug Research and Child Health (NEUROFARBA), Section of Pharmaceutical and Nutraceutical Sciences, University of Florence, Via Ugo Schiff, 6, 50019 Sesto Fiorentino, FI, Italy
Interests: medicinal chemistry; rational drug design; heterocyclic compounds; structure–activity relationships; adenosine receptor ligands; carbonic anhydrase inhibitors; protein kinase CK1 and CK2 inhibitors; ecto-5'-nucleotidase (CD73) inhibitors
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Maria Lurdes Santos Cristiano (https://sciprofiles.com/profile/902369)
Website (http://www.degois.pt/visualizador/curriculum.jsp?key=1312780297183882)
Editorial Board Member
1. Faculty of Science and Technology, Department of Chemistry and Pharmacy, University of Algarve, 8005-139 Faro, Portugal
2. Center of Marine Sciences - CCMar, University of Algarve, 8005-139 Faro, Portugal
Interests: physical organic chemistry; organic reactivity; medicinal chemistry; bioactive heterocyclic compounds; antiparasitic compounds

Dr. Luís Manuel Lopes Rodrigues Da Silva (https://sciprofiles.com/profile/76010)
Website (https://orcid.org/0000-0001-5264-3516)
Editorial Board Member
1. CPIRN-UDI-IPG–Research Unit for Inland Development, Center for Potential and Innovation of Natural Resources, Polytechnic of Guarda, Av. Dr. Francisco Sá Carneiro, 506300-559 Guarda, Portugal
2. Health Sciences Research Centre (CICS-UBI), Beira Interior University, Av. Infante D. Henrique, 6201-506 Covilhã, Portugal
Interests: microbiology; food microbiology; bioactive compounds as health promotors; bioactivity; functional foods; valorization of agrofood industry by-products; circular economy
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Michael Danienko (https://sciprofiles.com/profile/173787)

Editorial Board Member

Department of Clinical Biochemistry and Pharmacology, Ben-Gurion University of the Negev, Beer Sheva 84105, Israel
Interests: acute myeloid leukemia; cell differentiation; vitamin D; vitamin D analogs; plant-derived bioactive compounds; redox signaling and regulation; calcium signaling; cell cycle regulation, apoptosis
Special Issues, Collections and Topics in MDPI journals

Dr. Michael Danquah (https://sciprofiles.com/profile/2373555)
Website (https://www.csu.edu/collegeofpharmacy/pharmasci/faculty.htm)
Editorial Board Member
Department of Pharmaceutical Sciences, Chicago State University, 9501 South King Drive, Chicago, IL 60628, USA
Interests: biodegradable polymers for controlled drug and nucleic acid delivery

Dr. Christophe Dardonville (https://sciprofiles.com/profile/180928)
Website (http://www.iqm.csic.es/en/parasite-chemotherapy/)
Editorial Board Member
1. Instituto de Química Médica—CSIC, Madrid, Spain
2. Medicinal Chemistry Institute—Spanish Council for Scientific Research, Madrid, Spain
Interests: medicinal chemistry; design and synthesis of antiparasitic agents for neglected tropical diseases (trypanosomiasis, leishmaniasis, malaria); cationic compounds; DNA binding study; pKa measurement
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Angela De Simone (https://sciprofiles.com/profile/1129940)
Website (https://www.dstfen.unito.it/do/docenti.pl/Alias?angela.desimone#tab-profilo)
Editorial Board Member
Department of Drug Science and Technology, University of Turin, via P.Giuria 9, 10125 Torino, Italy
Interests: medicinal chemistry; pharmaceutical analysis; drug discovery; Alzheimer's Disease; ADME

Prof. Dr. Dhimant Desai (https://sciprofiles.com/profile/922044)
Website (https://cancer.psu.edu/researchers/individual/-/researcher/5B6500F63D0138DBE0540010E056499A/dhimant-desai-phd)
Editorial Board Member
Pennsylvania State University College of Medicine, Hershey, PA 17033, USA
Interests: synthesis; chemopreventive agent; chemotherapeutic agent; enviromental carcinogens; in vitro and in vivo studies; leukemia; melanoma; colon cancer
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Micheline Draye (https://sciprofiles.com/profile/929470)
Website (https://edytem.cnrs.fr/pages-personnelles/micheline-draye/)
Editorial Board Member
Laboratory of Chimie Moléculaire et Environnement - LCME, University Savoie Mont Blanc, F-73000 Chambéry, France
Interests: biodiesel; chemistry; green chemistry; catalysis; ionic liquids; biomass valorization; hydrometallurgy; strategic metal electrodeposition

Prof. Dr. Gunars Duburs (https://sciprofiles.com/profile/351508)
Website (http://www.osi.lv)

Editorial Board Member

Latvian Institute of Organic Synthesis, Division of Chemical, Biological and Medical Sciences, Latvian Academy of Sciences, Aizkraukles 21, LV 1006 Rīga, Latvia

Interests: heterocyclic chemistry (partially hydrogenated azines: dihydro- (tetrahydro-) pyridines, pyrimidines, polycyclic derivatives) - studies of chemical and biological properties; medicinal chemistry (synthesis and studies of cardiovascular, antioxidative, membrane protective, radioprotective, UV-protective agents)

Dr. Francois Dufrasne (https://sciprofiles.com/profile/121564)

Website (https://pharmacie.ulb.be/version-francaise/la-recherche/les-unites-de-recherche/microbiologie-chimie-bioorganique-et-macromoleculaire-mc/microbiologie-chimie-bioorganique-et-macromoleculaire-mc)

Editorial Board Member

Faculté de Pharmacie, Université Libre de Bruxelles, Campus Plaine CP 205/5, 1050 Brussels, Belgium

Interests: medicinal chemistry; organic synthesis; asymmetric synthesis

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Antoni Camins Espuny (https://sciprofiles.com/profile/367868)

Website1 (http://www.neurociencies.ub.edu/antoni-camins-espuny/) **Website2 (https://ciberned.es/grupo-camins.html)** **Website3 (https://webgrec.ub.edu/webpages/000003/cas/camins.ub.edu.html)**

Editorial Board Member

1. Department of Pharmacology, Toxicology and Therapeutic Chemistry, Faculty of Pharmacy, University of Barcelona, 08028 Barcelona, Spain
2. Institut de Neurociències , University of Barcelona, 08028 Barcelona, Spain
3. Biomedical Research Networking Centre in Neurodegenerative Diseases (CIBERNED), Instituto de Salud Juan Carlos III, 28031 Madrid, Spain

Interests: Alzheimer's disease; aging; apoptosis; neuropharmacology; epilepsy

Special Issues, Collections and Topics in MDPI journals

Dr. Marialuigia Fantacuzzi (https://sciprofiles.com/profile/545104)

Website (https://www.unich.it/ugov/person/1953)

Editorial Board Member

Department of Pharmacy, “G. d’Annunzio” University of Chieti-Pescara, Chieti, Italy

Interests: drug discovery; computational techniques; anticancer agents; aromatase inhibitors

Special Issues, Collections and Topics in MDPI journals

Dr. Luís M. T. Frija (https://sciprofiles.com/profile/848329)

Website (https://orcid.org/0000-0003-3252-3482)

Editorial Board Member

Centro de Química Estrutural, Instituto Superior Técnico - Universidade de Lisboa, Lisbon, Portugal

Interests: organic chemistry; tetrazoles, thiazoles and thiadiazoles; nitrogen ligands; organocatalysis; metal catalysis; selective chelators for metals on biological medium; leads for cancer chemotherapy

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Hiroyuki Fukui (https://sciprofiles.com/profile/435734)

Website (https://www.researchgate.net/profile/Hiroyuki_Fukui)

Editorial Board Member

Department of Molecular Studies for Incurable Diseases, Tokushima University, Tokushima 770-0855, Japan
Interests: molecular pharmacology; anti-allergic; natural medicines; pathological mechanism of allergy; histamine h1 receptor
Special Issues, Collections and Topics in MDPI journals

Dr. Assunta Giordano (https://sciprofiles.com/profile/2276370)
Website (https://www.icb.cnr.it/en/teams/assunta-giordano-2/)
Editorial Board Member
Istituto di Chimica Biomolecolare-CNR, Via Campi Flegrei, 34, 80078 Pozzuoli, Italy
Interests: drug discovery; bioactive compounds; small molecules; anticancer activity; medicinal chemistry; synthesis; structure–activity relationships; anti-inflammatory agents; mPGES-1 inhibitors; prostaglandin E2 biosynthesis; epigenetic drugs; BRD9; JMJD3 inhibitors; erbB4 inhibitors

Dr. Raffaella Gozzelino (https://sciprofiles.com/profile/147880)
Website (http://cedoc.unl.pt/inflamm-and-neurodeg/)
Editorial Board Member
1. Chronic Disease Research Center (CEDOC)/NOVA Medical School, NOVA University of Lisbon, 1180-052, 1150-082 Lisbon, Portugal
2. Atlantic Technical University (UTA), Mindelo, São Vicente, CP 2110, Cabo Verde
Interests: gut microbiota; gut microbiome; iron metabolism; heme biology; inflammation; infections and neurodegeneration
Special Issues, Collections and Topics in MDPI journals

Dr. Barbara Guerra (https://sciprofiles.com/profile/217294)
Website (https://portal.findresearcher.sdu.dk/en/persons/barbarag)
Editorial Board Member
Dept. of Biochemistry and Molecular Biology, Section for Translational Biology, University of Southern Denmark, Campusvej 55, 5230 Odense, Denmark
Interests: cell cycle regulation; DNA damage response; cell signalling; protein kinases; kinase inhibitors; cancer; cardiac muscle cells biology

Prof. Dr. Hirofumi Hanaoka (https://sciprofiles.com/profile/2615223)
Website (https://nrid.nii.ac.jp/nrid/1000050361390/)
Editorial Board Member
Department of Radiotheranostics, Gunma University Graduate School of Medicine, 3-39-22 Showa-machi, Maebashi 371-8511, Japan
Interests: radiopharmaceutical sciences; radionuclide therapy; theranostics; photoimmunotherapy
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Tsai-Ching Hsu (https://sciprofiles.com/profile/218905)
Website (https://medicine.csmu.edu.tw/p/405-1046-51129,c3717.php?Lang=zh-tw)
Editorial Board Member
Institute of Medicine, Chung Shan Medical University, Taichung 402, Taiwan
Interests: chronic pharmacology; molecular pharmacology; translational pharmacology/medicine

Dr. Domenico Iacopetta (https://sciprofiles.com/profile/78931)

Website (https://www.researchgate.net/profile/Domenico-Iacopetta-2)

Editorial Board Member

Department of Pharmacy, Health and Nutritional Sciences, University of Calabria, Via Pietro Bucci, 87036 Arcavacata di Rende, Italy

Interests: food; medicinal chemistry; bioactive products; nutraceuticals; phytochemicals; natural products extraction and isolation; antioxidants; anti-inflammatory; antimicrobials enzyme inhibition; cancer; cell biology

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Jesus Jimenez-Barbero (https://sciprofiles.com/profile/345789)

Website (https://www.cicbiogune.es/)

Editorial Board Member

1. CIC bioGUNE, Bizkaia Technology Park, Building 800, 48160 Derio, Spain
2. Ikerbasque, Basque Foundation for Science, Maria López de Haro 3, 48013 Bilbao, Spain

Interests: NMR; molecular recognition; glycans; protein-ligand interactions; chemical biology; medicinal chemistry; infectious diseases; cancer; rare diseases; metabolomics

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Paweł Kafarski (https://sciprofiles.com/profile/1320480)

Website (http://wril.uwm.edu.pl/kch/prof-dr-hab-inz-pawel-kafarski)

Editorial Board Member

Chair of Chemistry, Department of Agriculture and Forestry, University of Warmia and Mazury, Olsztyn, Poland

Interests: drug design and development; natural product chemistry; food chemistry

Special Issues, Collections and Topics in MDPI journals

Dr. Jong Heon Kim (https://sciprofiles.com/profile/1187402)

Website (https://www.ars.usda.gov/pacific-west-area/albany-ca/wrrc/ftdp/people/jong-heon-kim/)

Editorial Board Member

Foodborne Toxin Detection and Prevention Research Unit, Western Regional Research Center, USDA-ARS, 800 Buchanan St., Albany, CA 94710, USA

Interests: antifungal intervention; drug repurposing; drug resistance; redox adjuvants; resistance management

Special Issues, Collections and Topics in MDPI journals

Dr. Nitesh K. Kunda (https://sciprofiles.com/profile/448927)

Website (https://www.stjohns.edu/academics/faculty/nitesh-k-kunda)

Editorial Board Member

Assistant Professor, Industrial Pharmacy and Pharmaceutics, Department of Pharmaceutical Sciences, College of Pharmacy and Health Sciences, St. John's University, Jamaica, NY, USA

Interests: inhaled drug delivery; thermostable vaccines; nanomedicine

Special Issues, Collections and Topics in MDPI journals

Dr. Sabina Lachowicz-Wiśniewska (https://sciprofiles.com/profile/2091715)
Website (https://www.researchgate.net/profile/Sabina-Lachowicz-Wisniewska)
Editorial Board Member
Faculty of Health Sciences, Department Food and Nutrition, Calisia University, 4 Nowy Świat Street, 62-800 Kalisz, Poland
Interests: nutraceuticals and functional foods; medicinal plants; bioactive compounds; HPLC; LC-MS; nutrition; antioxidant agent; prebiotics; probiotics; symbiotics; bioavailability in vitro
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Marc Le Borgne (https://sciprofiles.com/profile/46056)
Website (http://b2mc.univ-lyon1.fr)
Editorial Board Member
Université de Lyon, Université Lyon 1, Faculté de Pharmacie - ISPB, EA 4446 Bioactive Molecules and Medicinal Chemistry, SFR Santé Lyon-Est CNRS UMS3453 - INSERM US7, 69373 Lyon CEDEX 8, France
Interests: ligand-based drug design; small molecules; heterocycles; glycoconjugates; structure-activity relationships; structural optimization; stability studies; cancer; chemoresistances; infectious diseases
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Bertrand Liagre (https://sciprofiles.com/profile/253422)
Website (https://www.unilim.fr/labcis/annuaire/membres-du-theme-1/liagre-b/)
Editorial Board Member
LABCiS UR 22722, Faculté de Pharmacie, Université de Limoges, 87000 Limoges, France
Interests: cancer; photodynamic therapy; apoptosis; cyclooxygenase-2
Special Issues, Collections and Topics in MDPI journals

Dr. Christos Liolios (https://sciprofiles.com/profile/1446971)

Editorial Board Member
1. Radiochemical Studies Laboratory, Institute of Nuclear & Radiological Sciences & Technology, Energy & Safety, National Centre for Scientific Research “Demokritos”, Ag. Paraskevi Attikis, 15310 Athens, Greece
2. Laboratory of Medicinal Chemistry, Department of Pharmacy, Section of Pharmaceutical Chemistry, National and Kapodistrian University of Athens, Panepistimioupolis–Zografou, 15771 Athens, Greece
Interests: molecular imaging; theranostics; multi targeting ligands

Dr. Simone Lucarini (https://sciprofiles.com/profile/359834)
Website (https://www.uniurb.it/persone/simone-lucarini)
Editorial Board Member
Department of Biomolecular Sciences, Section of Chemistry, School of Pharmacy, University of Urbino, Urbino, Italy
Interests: medicinal chemistry; NMR; synthetic organic chemistry; anticancer drugs; melatonin; bisindoles; sugar-based surfactants; adenosine A2A receptor ligands; asymmentric synthesis; macrocycles; foldamers

Dr. Sonia Malik (https://sciprofiles.com/profile/2291002)
Website (https://orcid.org/0000-0001-5224-3838)
Editorial Board Member

Laboratory of Woody Plants and Crops Biology (LBLGC), University of Orleans, Orleans, France
Interests: plant biotechnology; tissue culture; plant specialized metabolites; genetic engineering

Prof. Dr. Carlos Alberto Manssour Fraga (https://sciprofiles.com/profile/16715)
Website (https://orcid.org/0000-0001-6733-7079)
Editorial Board Member
1. Laboratório de Avaliação e Síntese de Substâncias Bioativas (LASSBio), Instituto de Ciências Biomédicas, Universidade Federal do Rio de Janeiro, Rio de Janeiro 21941-909, Brazil
2. Programa de Pós-Graduação em Farmacologia e Química Medicinal, Instituto de Ciências Biomédicas, Universidade Federal do Rio de Janeiro, Rio de Janeiro 21941-909, Brazil
Interests: medicinal chemistry; drug design and discovery; multitarget drugs for neurodegenerative diseases; use of privileged structures to design new epigenetic drug candidates; discovery of new kinase inhibitors for chronic inflammatory diseases
Special Issues, Collections and Topics in MDPI journals

Dr. Dominique Massotte (https://sciprofiles.com/profile/718843)
Website (https://www.researchgate.net/profile/Dominique-Massotte/2)
Editorial Board Member
French National Centre for Scientific Research, Institut des Neurosciences Cellulaires et Intégratives, University of Strasbourg, 67000 Strasbourg, France
Interests: opioid system; opioid receptors; G protein-coupled receptor trafficking and signaling; G protein-coupled receptor heteromerization; G protein-coupled receptor in addiction or chronic pain (preclinical models)
Special Issues, Collections and Topics in MDPI journals

Dr. Andrea Maxia (https://sciprofiles.com/profile/288076)
Website (https://unica.it/unica/it/ateneo_s07_ss01.page?contentId=SHD30613)
Editorial Board Member
Department of Life and Environmental Sciences, University of Cagliari, 09123 Cagliari, Italy
Interests: ethnobotany; economic botany; essential oils; biological activity; medicinal and aromatic plants
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Antonello Merlino (https://sciprofiles.com/profile/22211)
Website (https://www.docenti.unina.it/#!/professor/414e544f4e454c4c4f4d45524c494e4f4d524c4e4e4c37344330364c38343550/attivita_ricerca)
Editorial Board Member
Department of Chemical Sciences, University of Naples Federico II (Complesso Universitario di Monte Sant'Angelo), Via Cintia, 80126 Napoli, Italy
Interests: protein-metal based drug adducts; X-Ray crystallography; protein metalation; protein-ligand interactions
Special Issues, Collections and Topics in MDPI journals

Dr. Cristina Müller (https://sciprofiles.com/profile/46197)

Website (https://www.psi.ch/en/zrw/people/cristina-mueller)

Editorial Board Member

Center for Radiopharmceutical Sciences, Paul Scherrer Institute, 5232 Villigen, Switzerland

Interests: radionuclide therapy; non-standard radionuclides; radiotheranostics

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Elena V. Navolotskaya (https://sciprofiles.com/profile/564894)

Editorial Board Member

Branch of Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry, Science Avenue, 6, 142290 Pushchino, Moscow Region, Russia

Interests: peptides; receptors; drugs; signal transduction

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Karsten Niefind (https://sciprofiles.com/profile/224914)

Website (http://www.strukturbiochemie.uni-koeln.de/)

Editorial Board Member

Institut für Biochemie, Department für Chemie, Universität zu Köln, Zülpicher Straße 47, D-50674 Köln, Germany

Interests: structural biology; protein crystallography; enzymology; biophysical chemistry; protein-protein interactions; protein-inhibitor interactions

Prof. Dr. Yuhei Nishimura (https://sciprofiles.com/profile/499063)

Website (https://orcid.org/0000-0003-1901-8799)

Editorial Board Member

Department of Integrative Pharmacology, Mie University Graduate School of Medicine, Tsu 514-8507, Japan

Interests: pharmacology; toxicology; primary cilia; neurodevelopmental disorder; integrative omics approach; zebrafish

Special Issues, Collections and Topics in MDPI journals

Dr. Monica Notarbartolo (https://sciprofiles.com/profile/364215)

Website (https://pure.unipa.it/en/persons/monica-notarbartolo-di-villarosa-4)

Editorial Board Member

Department of Biological, Chemical and Pharmaceutical Sciences and Technologies (STEBICEF), University of Palermo, 90128 Palermo, Italy

Interests: drug resistance; anticancer drug; natural compounds; essential oil

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Valentina Onnis (https://sciprofiles.com/profile/166326)

Website1 (http://corsi.unica.it/sciviama/people/phd-board/valentina-onnis/) **Website2 (http://people.unica.it/valentinaonnis/)**

Editorial Board Member

Department of Life and Environmental Sciences, Unit of Pharmaceutical, Pharmacological and Nutraceutical Sciences, University of Cagliari, University Campus, I-09042 Monserrato, Cagliari, Italy

Interests: medicinal chemistry; nitrogen heterocycles; antiproliferative compounds; enzyme inhibitors
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. María Jesús Pérez Pérez (https://sciprofiles.com/profile/557452)
Website (http://www.iqm.csic.es/en/nucleosides-and-analogues/)
Editorial Board Member
Instituto de Química Médica (IQM-CSIC), Juan de la Cierva 3, E-28006 Madrid, Spain
Interests: antivirals; alphavirus; flavivirus; mRNA capping; nucleosides
Special Issues, Collections and Topics in MDPI journals

Dr. Silviya Petrova Zustiak (https://sciprofiles.com/profile/1150541)
Website (http://zustiaklab.com)
Editorial Board Member
1. Department of Biomedical Engineering, School of Science and Engineering, Saint Louis University, 3507 Lindell Boulevard, St. Louis, MO 63103, USA
2. Co-Director, Institute for Drug and Biotherapeutic Innovation, Saint Louis University, St. Louis, MO, USA
Interests: drug delivery; drug screening platforms; hydrogels; nanocomposites; glioblastoma
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Lawrence Marc Pfeffer (https://sciprofiles.com/profile/125467)
Website (http://www.researchgate.net/profile/Lawrence_Pfeffer)
Editorial Board Member
Center for Cancer Research, University of Tennessee Health Science Center, Memphis, TN 38163, USA
Interests: cancer stem-like cells; interferons; cytokines; gene expression; JAK-STAT signaling

Prof. Dr. Leonidas A. Phylactou (https://sciprofiles.com/profile/12660)
Website (https://www.cing.ac.cy/easyconsole.cfm/id/618)
Editorial Board Member
Chief Executive Officer and Medical Director, The Cyprus Institute of Neurology & Genetics, PO Box 23462, Nicosia 1683, Cyprus
Interests: RNA biology; regulatory RNA molecules; extracellular vesicles; identification of genetic defects in inherited diseases
Special Issues, Collections and Topics in MDPI journals

Dr. Diana Cláudia Pinto (https://sciprofiles.com/profile/79205)
Website (https://laqv.requimte.pt/people/1715-diana_claudia_gouveia_alves_pinto)
Editorial Board Member
LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, 3810-193 Aveiro, Portugal
Interests: organic chemistry; medicinal chemistry; biotransformations; natural products; plant chemical profile; sustainable chemistry
Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Andrea Porcheddu (https://sciprofiles.com/profile/282049)
Website (http://people.unica.it/andreaporcheddu/)
Editorial Board Member
Dipartimento di Scienze Chimiche e Geologiche, Università di Cagliari, Cittadella Universitaria, SS 554 Bivio Sestu, 09042 Monserrato, CA, Italy
Interests: peptide synthesis; peptide nucleic acid; indole synthesis; amide synthesis; mechanochemical reaction; borrowing hydrogen; microwave; heterocycle synthesis; hydroxamic acids

Dr. Alessandro Pratesi (https://sciprofiles.com/profile/1142859)
Website (https://ricerca.dcci.unipi.it/pratesi-alessandro.html)
Editorial Board Member
Department of Chemistry and Industrial Chemistry, University of Pisa, Via Giuseppe Moruzzi, 13, 56124 Pisa, Italy
Interests: inorganic chemistry; medicinal chemistry; bioinorganic chemistry; mass spectrometry; metal-based drugs; gold-based compounds, platinum-based compounds; drug targeting and delivery strategies; DNA and protein interactions; anticancer therapies; drug repurposing
Special Issues, Collections and Topics in MDPI journals

Dr. Ziyaur Rahman (https://sciprofiles.com/profile/869441)
Website (https://www.researchgate.net/profile/Ziyaur-Rahman)
Editorial Board Member
Irma Lerma Rangel College of Pharmacy, Department of Pharmaceutical Sciences, Texas A&M Health Science Center, Texas A&M University, College Station, TX 77843, USA
Interests: formulation development; manufacturing science; process monitoring; drug delivery; immediate and modified release dosage forms; 3D printing; regulatory science; multivariate analysis
Special Issues, Collections and Topics in MDPI journals

Dr. Barbara Ruaro (https://sciprofiles.com/profile/1139879)
Website (https://www.researchgate.net/profile/Barbara_Ruaro)
Editorial Board Member
Pulmonology Unit, Department of Medical Surgical and Health Sciences, University Hospital of Cattinara, University of Trieste, 34149 Trieste, Italy
Interests: interstitial lung disease, idiopathic pulmonary fibrosis, rheumatic diseases, pulmonary arterial hypertension (PAH)
Special Issues, Collections and Topics in MDPI journals

Dr. Maria M. M. Santos (https://sciprofiles.com/profile/167500)
Website (https://imed.ulisboa.pt/cv/maria-m-m-santos/)
Editorial Board Member
Faculty of Pharmacy, Universidade de Lisboa, Avenida Professor Gama Pinto, 1649-003 Lisboa, Portugal
Interests: organic synthesis; medicinal chemistry; heterocycles; anticancer drugs; p53 activators; NMDA receptor antagonists
Special Issues, Collections and Topics in MDPI journals

Dr. Osvaldo Andrade Santos-Filho (https://sciprofiles.com/profile/1017981)
Website (https://www.ippn.ufrj.br/osvaldo-filho/)

Editorial Board Member

Laboratory of Molecular Modeling and Computational Structural Biology, Center of Health Sciences, Federal University of Rio de Janeiro, IPPN, Av. Carlos Chagas Filho 373, Bloco H, Rio de Janeiro 21941-599, RJ, Brazil

Interests: molecular modeling; computational and medicinal chemistry; molecular simulations; structural biology

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Stefania Sarno

Website (http://www.biomed.unipd.it/people/sarno-stefania/)

Editorial Board Member

Department of Biological Chemistry, School of Medicine, University of Padova, Padua, Italy

Interests: drug discovery; small molecules; antitumor agents; kinase inhibitors; epigenetic drugs

---

Prof. Marco Scarselli (https://sciprofiles.com/profile/1703402)

Website (https://unimap.unipi.it/cercapersone/dettaglio.php?ri=87266)

Editorial Board Member

Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, 56128 Pisa, Italy

Interests: GPCRs; neurodegenerative disorders; psychiatric disorders; antipsychotics; mood stabilizers; antidepressants

Special Issues, Collections and Topics in MDPI journals

Dr. Martin Smiesko (https://sciprofiles.com/profile/351096)

Website (https://pharma.unibas.ch/de/research-groups/molecular-modeling/)

Editorial Board Member

Department of Pharmaceutical Sciences, Universitat Basel, Basel, Switzerland

Interests: molecular docking; molecular dynamics simulations; cytochrome P450; nuclear receptor; off-target binding; toxicity prediction; computer-aided / rational drug design; carbohydrate mimics

Special Issues, Collections and Topics in MDPI journals

Prof. Dr. Pascal Sonnet (https://sciprofiles.com/profile/34510)

Website (https://www.u-picardie.fr/labo/LG/personnel/Axe_CV/Pascal_SONNET.php)

Editorial Board Member

AGIR (Agents Infectieux, Résistance et chimiothérapie), UFR de Pharmacie, Université de Picardie Jules Verne, 1, rue des Louvels, CEDEX 01, 80037 Amiens, France

Interests: medicinal chemistry; organic synthesis; drug design, study, structure-activity relationships of antimicrobial drugs; antimalarial drugs; antibacterial drugs; analogs of siderophores, iron chelators

---

Dr. Arpad Szallasi (https://sciprofiles.com/profile/2243851)

★ **(https://recognition.webofscience.com/awards/highly-cited/2021/)** **Website (https://pilapharma.com/staff-member/arpad-szallasi/)**

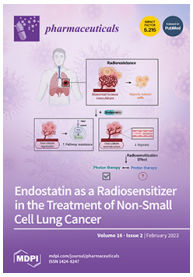
Editorial Board Member

Department of Pathology and Experimental Cancer Research, Semmelweis University,1085 Budapest, Hungary

Interests: the capsaicin receptor TRPV1; small molecule TRP inhibitors; TRP channels and cancer; neurogenic inflammation and cancer; cancer pain

Special Issues, Collections and Topics in MDPI journals

Pharmaceuticals, Volume 16, Issue 2 (February 2023) – 194 articles



Cover Story (**view full-size image (/files/uploaded/covers/pharmaceuticals/big_cover-pharmaceuticals-v16-i2.png)**): Non-small cell lung cancer (NSCLC) is the most prevalent type of lung cancer, making up about 85% of all lung cancer cases. Tumour angiogenesis has been intensely studied as a target for NSCLC treatment and several anti-angiogenic drugs, such as recombinant endostatin (RE), have been proposed to induce tumour growth inhibition with mixed results. Recently, a renewed interest in RE has emerged, due to its ability to create a vascular normalization window, which results in radiosensitivity enhancement by improving the hypoxic tumour microenvironment. This review provides a timely overview of preclinical and clinical studies that combine RE and radiotherapy for NSCLC treatment, while highlighting the ongoing challenges that must be overcome in order to maximize the benefits of this treatment; as well as the potential advantage of combinations with particle therapy. **View this paper (https://www.mdpi.com/1424-8247/16/2/219)**

Issues are regarded as officially published after their release is announced to the **table of contents alert mailing list (/journal/pharmaceuticals/toc-alert)**.

- You may **sign up for e-mail alerts (/journal/pharmaceuticals/toc-alert)** to receive table of contents of newly released issues.
- PDF is the official format for papers published in both, html and pdf forms. To view the papers in pdf format, click on the "PDF Full-text" link, and use the free **Adobe Reader (http://www.adobe.com/)** to open them.

Order results

Publication Date

Result details

Normal

Section

All Sections

Show export options

Open Access Article

(/1424-8247/16/2/327/pdf?version=1677228535)

Developing In Situ Chemometric Models with Raman Spectroscopy for Monitoring an API Disproportionation with a Complex Polymorphic Landscape (/1424-8247/16/2/327)

by **Shikhar Mohan (https://sciprofiles.com/profile/2708830)**, **Yi Li (https://sciprofiles.com/profile/author/Z1FBNzdRRXRrQk5xNzY0azZNR2JjMFp5WE9ia3c3RFhaQ0VHbmtYeS9XTT0=)**, **Kevin Chu (https://sciprofiles.com/profile/author/Y0hJem9VZC8zMEtvRTRrUlF2NkNqWEZvTDFUUE5lQkNBVHdOVG5nTmtzST0=)**, **Bing Shi (https://sciprofiles.com/profile/author/WmFtYWZ1Q3RNY3J3SGRtY0hxMytlV293ZGtHTGFRcGZTZ3NFS25QTFBJZz0=)**,

José Fernando Lazarini-Ruiz (https://sciprofiles.com/profile/author/YmUrZE4xcytYbmNaQjlyWU1Ec0c3Tm9pY09rUDFBdjFhUjB6NXdDN0RiTT0=),
Katia Vanessa Gutiérrez-Quiroz (https://sciprofiles.com/profile/author/ZjU5QjZMTFVPZWxZU3pvUDh1OVRhdUxoVkJnWUE4Q05KVllnN0NDNWhrV
and
Luis M. Teran (https://sciprofiles.com/profile/1227341)

Pharmaceuticals **2023**, *16*(2), 270; **https://doi.org/10.3390/ph16020270 (https://doi.org/10.3390/ph16020270)** - 10 Feb 2023
Viewed by 801

Abstract The discovery of the mechanism underlying allergic disease, mouse models of asthma, and bronchoscopy studies provided initial insights into the role of Th2-type cytokines, including interlukin (IL)-4, IL-5 and IL-13, which became the target of monoclonal antibody therapy. Omalizumab, Benralizumab, Mepolizumab, Reslizumab, and **[...] Read more.**

(This article belongs to the Special Issue **Drug Candidates for Allergic Diseases (/journal/pharmaceuticals/special_issues/allergic_pharmaceutical)**)

► Show Figures

(https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00270/article_deploy/html/images/pharmaceuticals-16-00270-g001-550.jpg?1676279461) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00270/article_deploy/html/images/pharmaceuticals-16-00270-g002-550.jpg?1676279463)

Open Access Article (/1424-8247/16/2/269/pdf?version=1676029124)

Phytofabrication and Characterisation of Zinc Oxide Nanoparticles Using Pure Curcumin (/1424-8247/16/2/269)

by Batoul Alallam (https://sciprofiles.com/profile/1062571), Abd Almonem Doolaanea (https://sciprofiles.com/profile/785398),
Mulham Alfatama (https://sciprofiles.com/profile/1258314) and Vuanghao Lim (https://sciprofiles.com/profile/168300)

Pharmaceuticals **2023**, *16*(2), 269; **https://doi.org/10.3390/ph16020269 (https://doi.org/10.3390/ph16020269)** - 10 Feb 2023
Viewed by 715

Abstract Zinc oxide and curcumin, on their own and in combination, have the potential as alternatives to conventional anticancer drugs. In this work, zinc oxide nanoparticles (ZnO NPs) were prepared by an eco-friendly method using pure curcumin, and their physicochemical properties were characterised. ATR-FTIR **[...] Read more.**

(This article belongs to the Special Issue **Pharmacological Activities of Flavonoids and Its Analogues (/journal/pharmaceuticals/special_issues/pharmacological_flavonoids)**)

► Show Figures

(https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-ag-550.jpg?1676029216) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g001-550.jpg?1676029205) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g002-550.jpg?1676029198) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g003-550.jpg?1676029200) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g004-550.jpg?1676029212) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g005-550.jpg?1676029196) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g006-550.jpg?1676029200) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g007-550.jpg?1676029194) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g008-550.jpg?1676029208) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g009-550.jpg?1676029214) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g010-550.jpg?1676029211) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00269/article_deploy/html/images/pharmaceuticals-16-00269-g011-550.jpg?1676029204)

Open Access Article (/1424-8247/16/2/268/pdf?version=1676877973)

Nornidulin, A New Inhibitor of *Plasmodium falciparum* Malate: Quinone Oxidoreductase (*Pf*MQO) from Indonesian *Aspergillus* sp. BioMCC f.T.8501 (/1424-8247/16/2/268)

by Alfian Wika Cahyono (https://sciprofiles.com/profile/author/UWR3RC9LUll2K0JGM3o5VmlnSmxuOEMzVFdLWHlTVzR3Rnk0a0c4L2QvZz0=),
Loeki Enggar Fitri (https://sciprofiles.com/profile/2166465),
Sri Winarsih (https://sciprofiles.com/profile/author/QUVwNUlxNHpNazlqNllieXBqaHJ5K2tWaEd2V2hwOWRrWE42TEtFaWNTaz0=),
Erwanyunni Endang Prabandari (https://sciprofiles.com/profile/author/SExpTTRDY1BPSVBXTVF2dEd3VDJlWVFsSDJBTm5wU3R3YmRPOVBzdEo
,
Danang Waluyo (https://sciprofiles.com/profile/author/TjhNbFgxMWhJOVNlTkQyUDNjN2VZQXhrUWdvcFRzcDJ0YWZLSGxlV2NFYz0=),
Amila Pramisandi (https://sciprofiles.com/profile/author/NVE1ajFiTVo5ODJvZmR0K01oeGVJZ0Zyajdsbm5vM1NTS3pAdm93RE5EQT0=),
Evita Chrisnayanti (https://sciprofiles.com/profile/author/ZTlzNklWVGJsam0ycEYyNFFlMlBWUlpra1l5RjVVbFM2cXd5ZzBNcS9yST0=),

Back to TopTop

Diana Dewi (https://sciprofiles.com/profile/author/VWNjeXhPclc2SDBnV3FZN2FlNmlYZ2tDUWlaVEdSOVFyWFBEaFJSeTdvYz0=),
Eka Siska (https://sciprofiles.com/profile/2766141),
Nurlaila Nurlaila (https://sciprofiles.com/profile/author/OU1TVnA5dmJXdDFmL09lNmZWZ2k3R1daUTNJckNkdXlST1pLTVJnVTRQTT0=),
Nuki Bambang Nugroho (https://sciprofiles.com/profile/author/L25qRU1aNkdlQm9QWTdETU4ySmhwQlBGQUV4OVA5M3RjbStpSy8vblRBbz0=),
Tomoyoshi Nozaki (https://sciprofiles.com/profile/356140) and Suciati Suciati (https://sciprofiles.com/profile/254089)
Pharmaceuticals **2023**, *16*(2), 268; https://doi.org/10.3390/ph16020268 (https://doi.org/10.3390/ph16020268) - 10 Feb 2023
Viewed by 422

Abstract This study aimed to obtain a microbial active compound as a novel antimalarial drug from Indonesian isolates. Target-based assays were used to screen for antimalarial activity against the parasite mitochondrial, *Plasmodium falciparum* malate:quinone oxidoreductase (*Pf*MQO) enzyme. In total, 1600 crude extracts, **[...] Read more.**

(This article belongs to the Section **Natural Products (/journal/pharmaceuticals/sections/natural_products)**)

► Show Figures

(https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-ag-550.jpg?1676878059)

(https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g001-550.jpg?1676878055) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g002-550.jpg?1676878054) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g003-550.jpg?1676878040) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g004-550.jpg?1676878038) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g005-550.jpg?1676878053) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g006-550.jpg?1676878043) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g007-550.jpg?1676878058) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g008-550.jpg?1676878041) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g009-550.jpg?1676878057) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g010-550.jpg?1676878044) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g011-550.jpg?1676878052) (https://pub.mdpi-res.com/pharmaceuticals/pharmaceuticals-16-00268/article_deploy/html/images/pharmaceuticals-16-00268-g012-550.jpg?1676878054)

Show export options

Displaying articles 1-194

Previous Issue
Volume 16, January (/1424-8247/16/1)

Next Issue
Volume 16, March (/1424-8247/16/3)

Pharmaceuticals (/journal/pharmaceuticals), EISSN 1424-8247, Published by MDPI

pharmaceuticals

MDPI

Article

Nornidulin, A New Inhibitor of *Plasmodium falciparum* Malate: Quinone Oxidoreductase (*Pf*MQO) from Indonesian *Aspergillus* sp. BioMCC f.T.8501

Alfian Wika Cahyono [1], Loeki Enggar Fitri [2,3,*], Sri Winarsih [3,4], Erwahyuni Endang Prabandari [5], Danang Waluyo [5], Amila Pramisandi [6], Evita Chrisnayanti [6], Diana Dewi [6], Eka Siska [5], Nurlaila Nurlaila [6], Nuki Bambang Nugroho [5], Tomoyoshi Nozaki [7] and Suciati Suciati [8]

1 Doctoral Program in Medical Science, Faculty of Medicine, Universitas Brawijaya, Malang 65145, East Java, Indonesia
2 Department of Parasitology, Faculty of Medicine, Universitas Brawijaya, Malang 65145, East Java, Indonesia
3 Malaria Research Group, Faculty of Medicine, Universitas Brawijaya, Malang 65145, East Java, Indonesia
4 Department of Microbiology—Department of Pharmacy, Faculty of Medicine, Universitas Brawijaya, Malang 65145, East Java, Indonesia
5 Research Centre for Vaccine and Drug, National Research and Innovation Agency, Cibinong Science Centre, Jalan Raya Bogor, Bogor 16143, West Java, Indonesia
6 Research Centre for Applied Microbiology, National Research and Innovation Agency, Cibinong Science Centre, Jalan Raya Bogor, Bogor 16143, West Java, Indonesia
7 Department of Biomedical Chemistry, Graduate School of Medicine, The University of Tokyo, Bunkyo-ku, Tokyo 113-8654, Japan
8 Department of Pharmaceutical Science, Faculty of Pharmacy, Universitas Airlangga, Surabaya 60115, East Java, Indonesia
* Correspondence: lukief@ub.ac.id; Tel.: +62-0341-551611

Citation: Cahyono, A.W.; Fitri, L.E.; Winarsih, S.; Prabandari, E.E.; Waluyo, D.; Pramisandi, A.; Chrisnayanti, E.; Dewi, D.; Siska, E.; Nurlaila, N.; et al. Nornidulin, A New Inhibitor of *Plasmodium falciparum* Malate: Quinone Oxidoreductase (*Pf*MQO) from Indonesian *Aspergillus* sp. BioMCC f.T.8501. *Pharmaceuticals* **2023**, *16*, 268. https://doi.org/10.3390/ph16020268

Academic Editor: Jong Heon Kim

Received: 6 January 2023
Revised: 6 February 2023
Accepted: 8 February 2023
Published: 10 February 2023

Abstract: This study aimed to obtain a microbial active compound as a novel antimalarial drug from Indonesian isolates. Target-based assays were used to screen for antimalarial activity against the parasite mitochondrial, *Plasmodium falciparum* malate:quinone oxidoreductase (*Pf*MQO) enzyme. In total, 1600 crude extracts, composed from 800 fungi and 800 actinomycetes extracts, were screened against *Pf*MQO, yielding six active extracts as primary hits. After several stages of stability tests, one extract produced by *Aspergillus* sp. BioMCC f.T.8501 demonstrated stable *Pf*MQO inhibitory activity. Several purification stages, including OCC, TLC, and HPLC, were performed to obtain bioactive compounds from this active extract. All purification steps were followed by an assay against *Pf*MQO. We identified the active compound as nornidulin based on its LC-MS and UV spectrum data. Nornidulin inhibited *Pf*MQO activity at IC_{50} of 51 µM and *P. falciparum* 3D7 proliferation in vitro at IC_{50} of 44.6 µM, however, it had no effect on the growth of several mammalian cells. In conclusion, we isolated nornidulin from Indonesian *Aspergillus* sp. BioMCC f.T.8501 as a novel inhibitor of *Pf*MQO, which showed inhibitory activity against the proliferation of *P. falciparum* 3D7 in vitro.

Keywords: *Aspergillus* sp. BioMCC f.T.8501; malaria; nornidulin; *Pf*MQO; *Plasmodium falciparum*; purification

1. Introduction

Malaria is an infectious disease caused by a parasite of the genus *Plasmodium*, which is transmitted through the bite of a female *Anopheles* mosquito. The World Health Organization reported that there were 241 million cases of malaria in 2020, with a mortality rate of 627,000, a 12% increase over 2019 [1]. One of the *Plasmodium* species causing severe and deadly malaria in humans is *Plasmodium falciparum* [2]. To date, malaria is treated by first-line chemotherapeutic agents, including artemisinin, artemether, artesunate, arteether, and its derivative, dihydroartemisinin. However, the single use of these drugs has been reported to induce drug-resistance parasites; therefore, the WHO recommended

artemisinin-based combination therapy (ACT) for effective treatment and to reduce the incidence of malaria [1,3]. Unfortunately, the efficacy of ACT has recently been reported to be declining. Evidence of resistance to malaria treatment in Cambodia and the Great Mekong sub region in Southeast Asia have been shown by the delayed clearance of parasites following ACT treatment of falciparum malaria [4,5]. Therefore, artemisinin-based triple combination therapy (TAC) was initiated for better treatment outcomes [5,6]. As the efficacy of current antimalarial drugs has been threatened by parasite resistance, efforts to discover new antimalarial agents are urgently needed [7,8].

Currently, ongoing efforts in the development of antimalarial agents exhibiting novel mechanisms of action are deemed important [3]. Several drug discovery strategies, including high throughput screening (HTS), have been used to identify active compounds against *Plasmodium* cells (whole-cell approach). Another breakthrough is the use of *Plasmodium* biochemical target proteins (target-based approach) [9]. Recently, enzymes involved in the mitochondrial electron transport chain (mtETC) gained attention as potential targets for anti-malarial drug development. *Plasmodium* mtETC contains five dehydrogenases: type II NADH dehydrogenase (NDH2), malate quinone oxidoreductase (MQO), dihydroorotate dehydrogenase (DHODH), glycerol 3-phosphate dehydrogenase (G3PDH), and succinate dehydrogenase (SDH) [10]. *Plasmodium falciparum* malate:quinone oxidoreductase (*Pf*MQO) is reported to exhibit promising targets in the development of new antimalarial drugs [8]. In addition to its roles in the mtETC, tricarboxylic acid, and fumarate cycles, *Pf*MQO is also critical for the *P. falciparum* life cycle at the asexual (erythrocytic) stage. Because MQO is not present in humans, this specific target reduces the risk of adverse effects in humans [8,11,12].

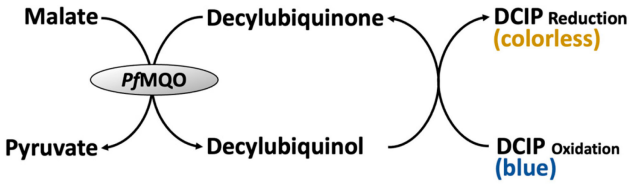
On the other side, microbes have become an important source for antimalarial drug discovery. *Streptomyces* sp. BioMCC-a.EP.1039 was found to produce borrelidin, a potent agent that inhibits the proliferation of *P. falciparum* 3D7 strains, as well as chloroquine/pyrimethamine/sulfadoxine-resistant K1 strains both in vitro and in vivo [12,13]. Several secondary metabolites derived from the endophytic fungus *Aspergillus unguis* BCC54176 have recently been reported to have a wide range of antimicrobial activities, including antimalarial activity, against *Plasmodium falciparum* (K1, multidrug-resistant strain) [14]. Despite the potential of microbes as a source for anti-malarial drug discovery, there is no report that microbial compounds have been reported to show inhibitory activity against *Pf*MQO.

This study aimed to screen and identify microbe-derived compounds that inhibit *Pf*MQO, and to assess its characteristics as antimalarial agents. We subjected extracts of Indonesia-originated fungi and actinomycetes deposited in the Biotech Center-BPPT Microbial Culture Collection (BioMCC) of the National Research and Innovation Agency (BRIN) to *Pf*MQO enzymatic reaction and screened them to obtain and identify the enzyme inhibitors using a high throughput screening (HTS) system. We also tested the inhibitory activity of the identified bioactive compound against the proliferation of the *P. falciparum* 3D7 cell in vitro, as well as its toxicity against several mammalian cells in vitro to confirm its specificity.

2. Results

2.1. HTS to Obtain Active Microbial Extract against PfMQO

Primary screening was carried out by subjecting 1600 microbial broth extracts, composed from 800 fungi and 800 actinomycetes extracts, into the *Pf*MQO assay system (Figure 1) on a 96-well plate format.

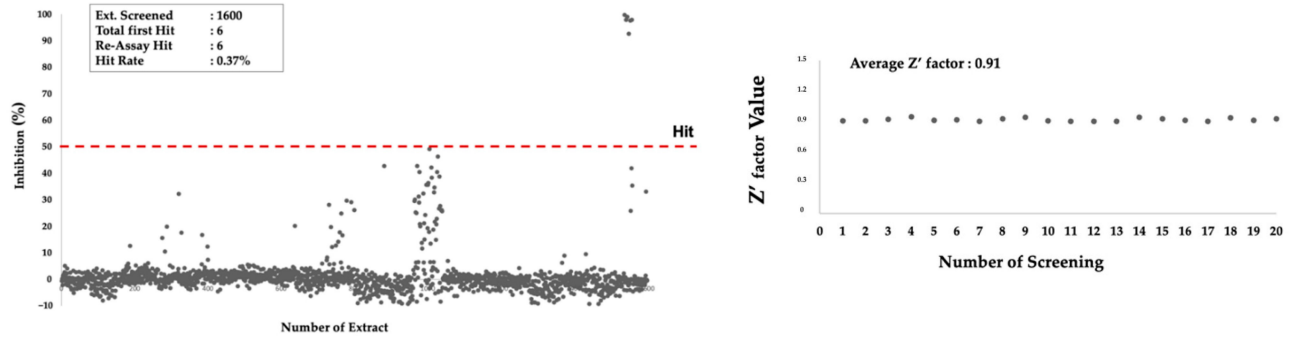


$$\% \, inhibition = 100 - \left[\left(\frac{sample - positive\ control}{negative\ control}\right) \times 100\ \%\right]$$

(**a**) (**b**)

Figure 1. Principle of *Pf*MQO enzyme-based assay. (**a**) *Pf*MQO assay reaction. Reduction in $DCIP_{ox}$ to $DCIP_{red}$ will turn the reaction color from blue into colorless, so the reaction can be simply monitored by measuring the absorbance of the reaction mixture at a wavelength of 600 nm. (**b**) Formula for calculating the *Pf*MQO inhibitory activity. Sample, difference of A_{660nm} of reaction mixture containing the sample measured at 20 min and 0 min of reaction; positive control, average difference of A_{600nm} of reaction mixture without the addition of the substrate measured at 20 min and 0 min of reaction; negative control, average difference of A_{600nm} of reaction mixture without the addition of sample measured at 20 min and 0 min of reaction.

The extracts that showed inhibitory activity more than 50% were regarded as primary hits. There were six extracts identified as primary hits, representing an overall hit rate of 0.37% (Figure 2a). The average of the z'factor value, a statistical parameter for monitoring the quality of the data from HTS, was 0.91 (Figure 2b), which is regarded as an excellent performance. All of the primary hits were produced by fungi. Since the assay system monitored the *Pf*MQO enzymatic reaction by a kinetic mode (time-course monitoring), we also checked whether the hits showed false positive results by observing the reaction color. The color of all hit-containing reactions remained blue, indicating that the hits were the true hits.



(**a**) (**b**)

Figure 2. Primary screening of microbial extracts against *Pf*MQO. (**a**) Inhibitory activity of 1600 microbial extracts against *Pf*MQO; red-dashed line represents threshold line; (**b**) z'factor value of each assay batch.

The re-assay of these hits against *Pf*MQO using the same samples resulted in a similar result. Thus, we then revived the microbes that produced these hits from the cryopreserved stock and tested the inhibitory activity of the extracts against *Pf*MQO. Surprisingly, only one of them was successfully revived. The inhibitory activity of the extract remained similar to that of the first screening result when the microbe was cultured in medium F2, but not in medium F4 (Figure 3).

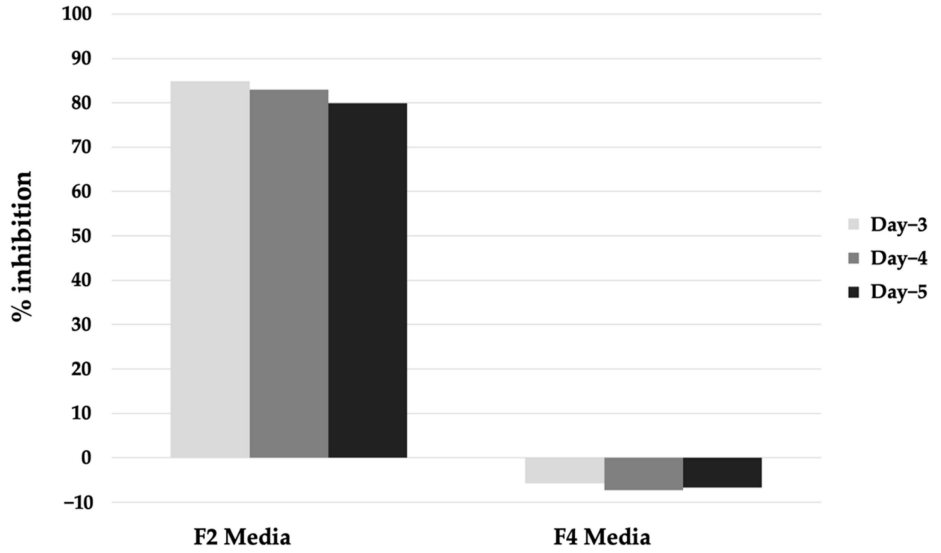


Figure 3. Inhibitory activity of extract of Aspergillus sp. BioMCC f.T.8501 cultured in F2 and F4 medium against PfMQO.

The active extract was produced from the culture broth of *Aspergillus* sp. BioMCC f.T.8501, as identified based on its morphological characterization carried out by macroscopic and microscopic observation (Supplementary Data Figures S1 and S2). The strain formed a yellowish colony on the MEA medium and the conidiophore was varied in length and smooth.

2.2. Preliminary Extraction Test

Before extraction and isolation of the bioactive compounds from the active microbial extract, it is important to characterize the properties of the active compounds. We performed a preliminary extraction test to assess the stability of the compounds and suitable solvents for extracting the compounds, as well as the localization of the active compounds in the culture broth, using a small amount of the extract, as described in the Materials and Methods. The test revealed that the mycelium extracted by methanol showed the highest inhibitory activity, compared to that of the supernatant fraction (Figure 4). We then extracted the remaining mycelium fraction of the extract by methanol and obtained 2.9 g of the dried extract.

2.3. Purification and Identification of Bioactive Compounds

The methanol extract was then subjected to a silica open column and eluted by chloroform: methanol mixed solvent with various ratios (see Section 4). Each fraction eluted from the column was subjected to the *Pf*MQO assay. Early fractions (Fr2-Fr8) showed high inhibitory activity, which indicated that the active compounds might be relatively nonpolar (Figure 5). We then analyzed these active fractions with silica TLC with 100% chloroform and visualized them under UV at a wavelength of 254 nm. Fr2 and Fr3 showed similar patterns with a bold spot. The other fractions showed different patterns compared to those of the first two fractions (see Supplementary Data Figure S3). Based on their activities and pattern similarity and the spot boldness of the TLC result, we decided to mix Fr2 and Fr3 (and named as FrA accordingly) and subjected them for further purification process.

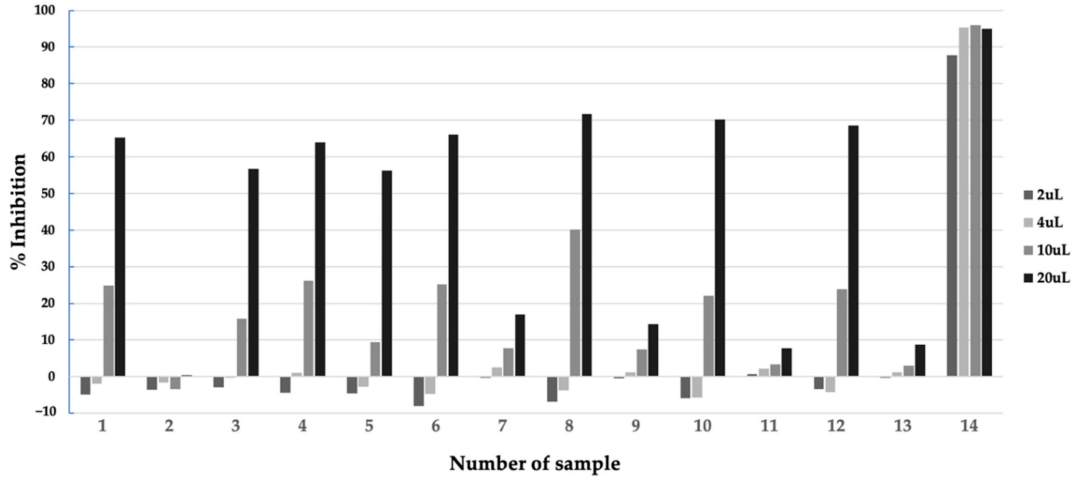


Figure 4. Inhibitory activity of samples from preliminary extraction test of extract of *Aspergillus* sp. BioMCC f.T.8501 culture broth in F2 medium against *Pf*MQO. Sample description: **1**, Supernatant; **2**, Supernatant (1/4 volume); **3**, Supernatant, pH 2, incubated at 60 °C for 1 h; **4**, Supernatant, pH 7, incubated at 60 °C for 1 h; **5**, Supernatant, pH 9, incubated at 60 °C for 1 h; **6**, Supernatant, pH 2, extracted with ethyl acetate, solvent layer; **7**, Supernatant, pH 2, extracted with ethyl acetate, water layer; **8**, Supernatant, pH 2, extracted with butanol, solvent layer; **9**, Supernatant, pH 2, extracted with butanol, water layer; **10**, Supernatant, pH 8, extracted with ethyl acetate, solvent layer; **11**, Supernatant, pH 8, extracted with ethyl acetate, water layer; **12**, Supernatant, pH 8, extracted with butanol, solvent layer; **13**, Supernatant, pH 8, extracted with butanol, water layer; **14**, Mycelium, extracted with methanol.

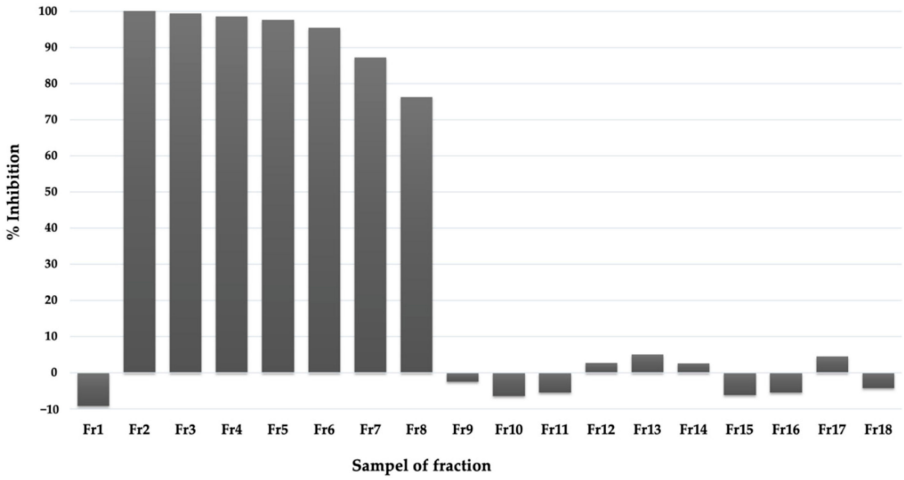


Figure 5. Inhibitory activity of fractions of active extracts eluted by mixed chloroform-methanol solvent from silica gel column chromatography against *Pf*MQO (see text for detail).

The HPLC profile of FrA showed five major peaks with high intensities and well-separated (Figure 6). Each peak, including the non-peak fraction, was isolated by semi-preparative HPLC (Figure 7a) and subjected to the *Pf*MQO assay. All of these peaks showed an inhibitory activity against *Pf*MQO (Figure 7b). Due to the limited amount, we chose Fr10 (corresponded to the 4th major peak with r.t. of 17.527 s) to be further characterized.

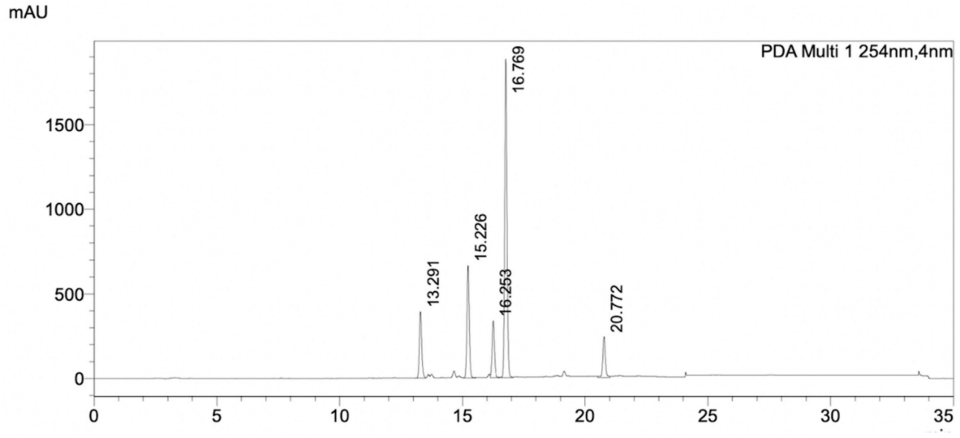
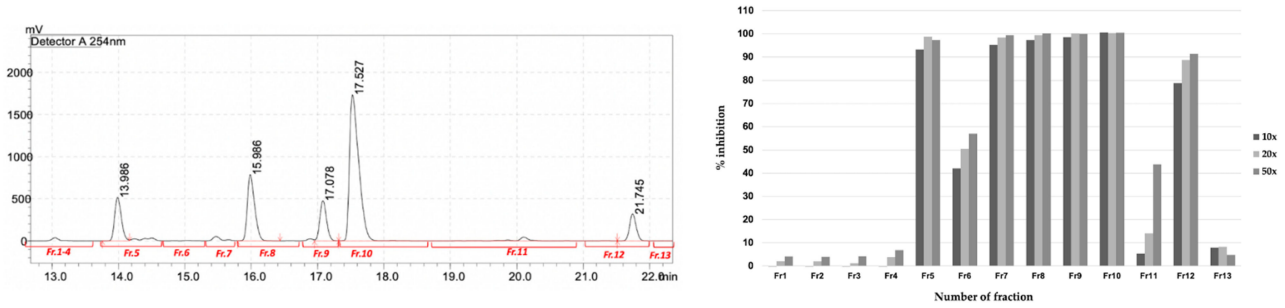


Figure 6. HPLC chromatogram of FrA from silica gel chromatography, separated by a C_{18} column. The data was taken by PDA detector. Detail of the HPLC condition is described in Section 4. The chromatogram showed the UV absorbance profile of the sample at wavelength of 254 nm.



(**a**) (**b**)

Figure 7. Purification of active compounds from FrA. (**a**) Semi-preparative HPLC chromatogram of the mixed active fraction, separated by a C_{18} column. The chromatogram showed UV absorbance profile of the sample at wavelength of 254 nm. Red bars underneath the chromatogram represent time-coursed sampling of fractions collected during the analysis. (**b**) Inhibitory activity of fractions collected from semi-preparative HPLC against *Pf*MQO. Sample was concentrated 10× (dark bar), 20× (light bar) or 50× (mid-dark bar) to represent a dose response of each sample.

When Fr10 was subjected for HPLC profiling, a single peak appeared on the HPLC chromatograms taken at 210 nm, 254 nm, and 300 nm (Figure 8a–c), suggesting that the Fr10 composed from a single compound. The LC-MS analysis results of this fraction revealed that the molecular weight of the compound was 429.00476 g/mol, with a molecular formula of $C_{19}H_{15}Cl_3O_5$ (Figure 9). We then searched the identity of the compound based on the LC-MS and UV spectrum (Figure 8d) data in the Dictionary of Natural Product database and identified the compound as nornidulin.

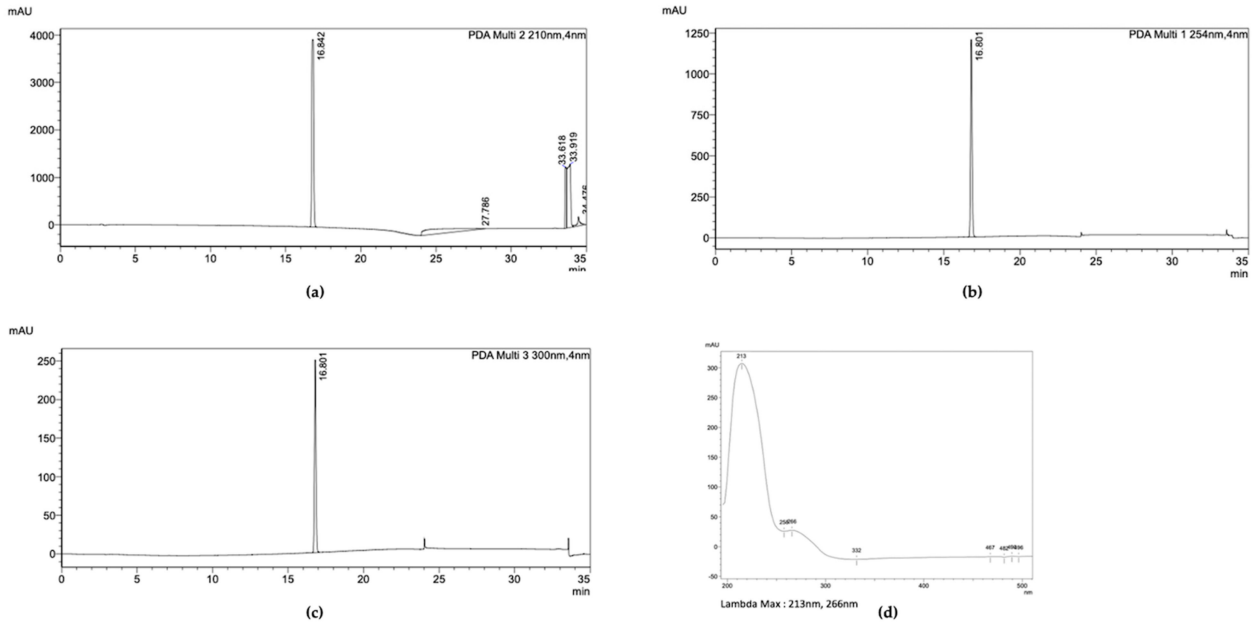


Figure 8. HPLC analysis of Fr10. The chromatogram showed the UV absorbance profile of Fr10 at wavelength of (**a**) 210 nm, (**b**) 254 nm, and (**c**) 300 nm. (**d**) UV spectrum of Fr10.

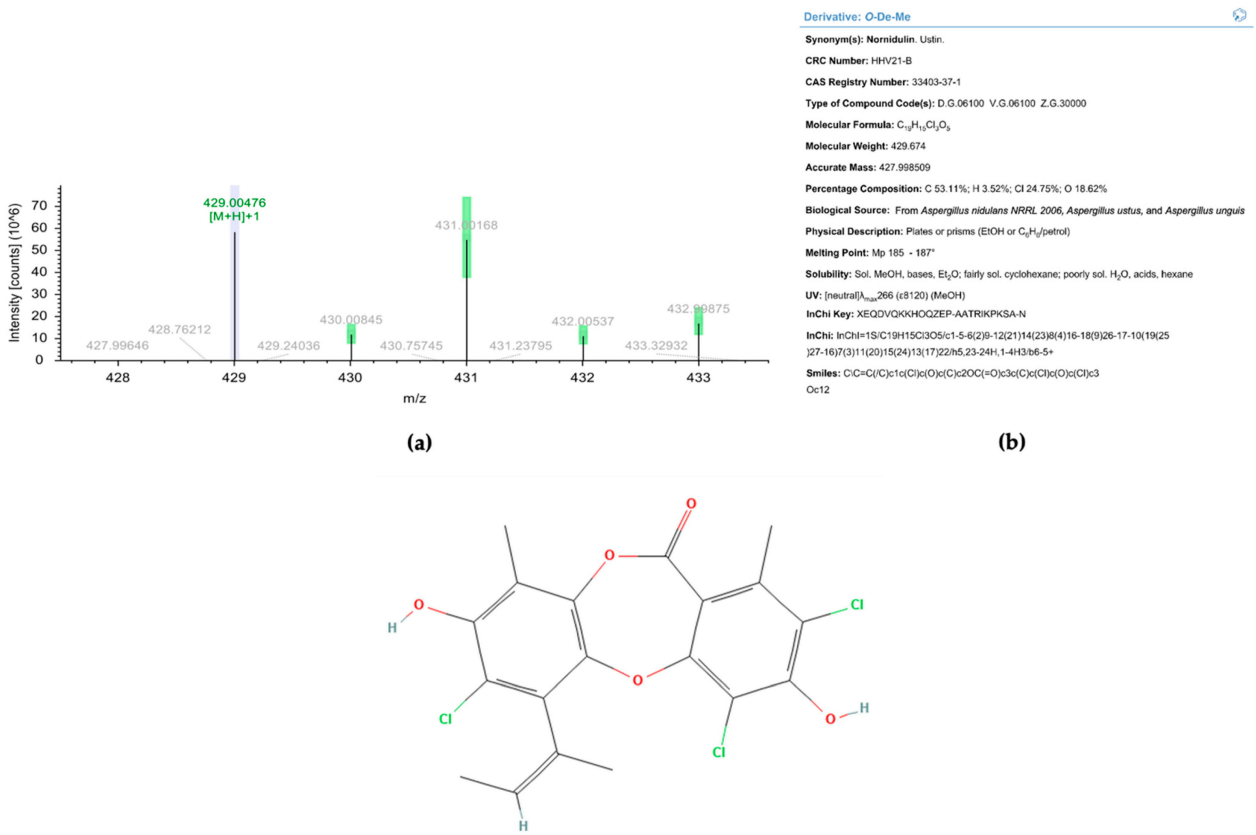


Figure 9. Liquid chromatography-mass spectrometry analysis of Fr10. (**a**) Electropherogram of Fr10 taken at positive mode. (**b**) Identification result of Fr10 from Dictionary of Natural Product database, based on UV spectrum and MS data. (**c**) Molecular structure of nornidulin (Pubchem ID 20056625).

2.4. Characterization of the Purified Compound

The nornidulin inhibited *Pf*MQO and the proliferation of *P. falciparum* 3D7 in vitro at IC_{50} of 51 µM and 44.6 µM, respectively (Figure 10). No toxicity to mammalian cell cultures was observed when the nornidulin was tested against the mammalian cell cultures (colorectal adenocarcinoma (DLD-1) and the African green monkey kidney (Vero) cell lines) up to 466 µM (Figure 11), resulting in a selectivity index of more than 10. However, we observed a hemolysis during *p*LDH assay at a concentration of 466 µM.

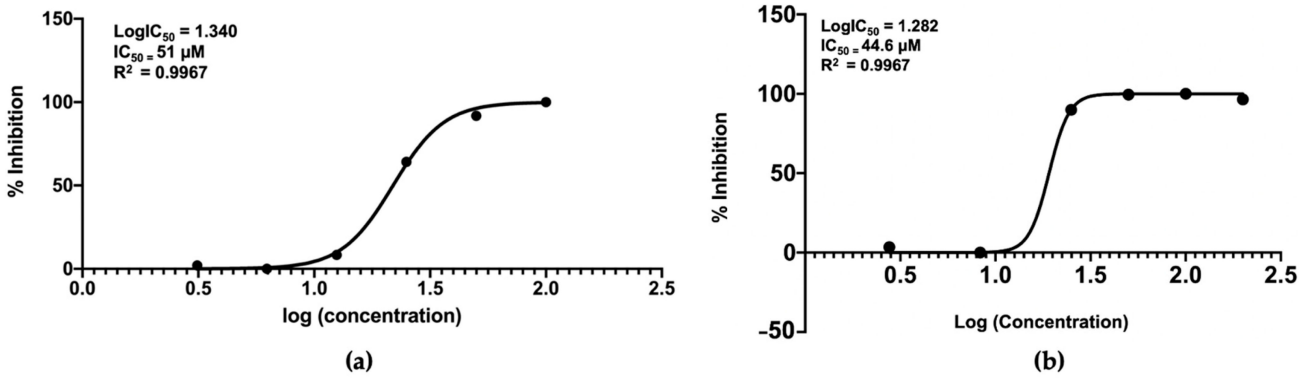


Figure 10. Inhibitory activity of nornidulin against *Pf*MQO (**a**) and proliferation of *P. falciparum* 3D7 cell in vitro, using *p*LDH assay method (**b**). The graph was drawn using GraphPad Prism V8 software.

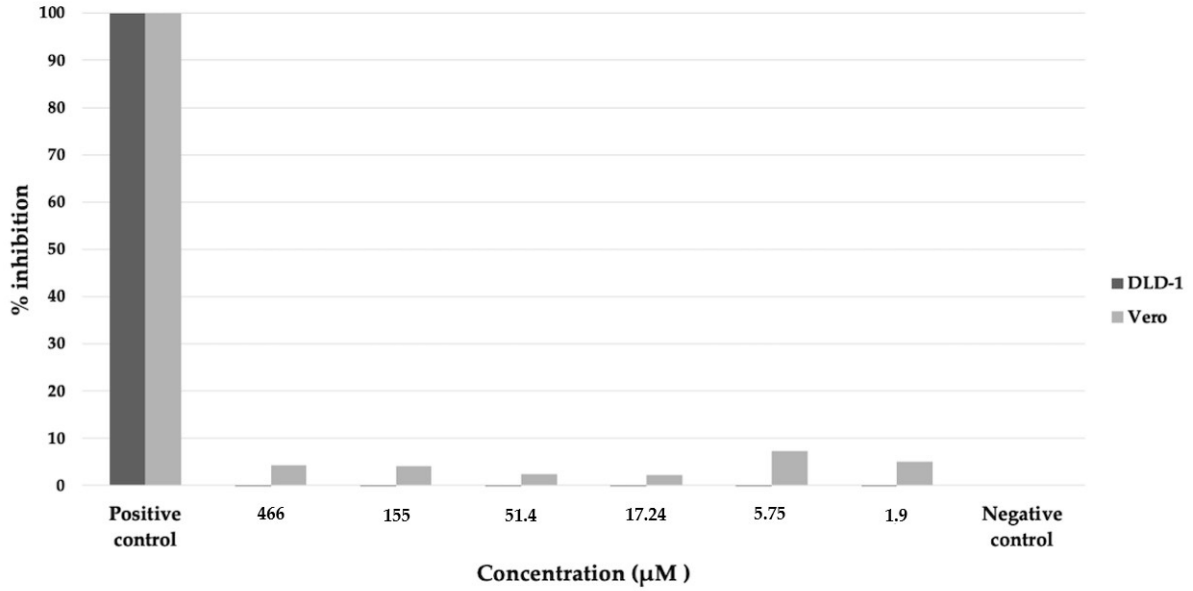


Figure 11. Cytotoxicity assay of nornidulin against colorectal adenocarcinoma (DLD-1, dark bar) and African green monkey kidney (Vero, light bar) cell lines. The assay was performed using CCK-8 method (see Materials and Methods). Positive control, culture medium without cell; negative control, cell culture without nornidulin.

3. Discussion

This study aimed to assess the potential of microbial resources for the discovery of the inhibitor of *Pf*MQO, an attractive target for anti-malarial drug discovery. We subjected 1600 microbial extracts into HTS against *Pf*MQO and obtained 6 extracts that were inhibited *Pf*MQO. Surprisingly, all of them were produced from fungi. This was consistent with the previous report, where none of the actinomycete's extract (which employed more than 7700 extracts) showed inhibitory activity against *Pf*MQO, as well as *Pf*DHODH, another

validated target involved in *P. falciparum* mtETC [12]. The *Pf*DHODH inhibitors that have been found are altenusin, mitorubrinol, and mitorubrinic acid, which were isolated from the Indonesian fungus *Talaromyces pinophilus* BioMCC f.T.3979 [15]. Therefore, fungi could become a useful source for anti-malarial drug discovery, particularly for searching the inhibitors of targets in plasmodial mtETC. At the same time, through this study, we also demonstrated the usefulness of Indonesian microbial strains as a source for searching inhibitors of *Pf*MQO.

In this study, we identified nornidulin, produced by *Aspergillus* sp. BioMCC f.T.8501, as an inhibitor of *Pf*MQO. Nornidulin is a depsidone derivative that is produced by marine- and soil-derived fungi, isolated first in 1945 from *Aspergillus nidulans*, and later from *Aspergillus ustus* and *Aspergillus unguis* [16–18]. *Aspergillus unguis* is known as a depsidones-producing fungus, which accounted for approximately 30% of the total produced compounds, along with depsides, phthalides, cyclopeptides, indanones, diaryl ethers, pyrones, benzoic acid derivatives, orcinol/orsenillate derivatives, and sesterpenoids. Nornidulin has been reported to show bioactivity as a larvicide and an antimicrobial. It is also reported to show bioactivity against cancer cell lines, animal growth promotion, antimalaria, and antioxidant [19]. Nornidulin inhibited aromatase with a IC_{50} value of 4.6 μM and showed radical scavenging activity in the xanthine/xanthine oxidase assay [20].

The bioactivity of nornidulin as an antimalarial agent was reported previously; it was demonstrated to inhibit the proliferation of the *P. falciparum* K1 strain at IC_{50} > 23.27 μM [14]. In this study, we demonstrated that nornidulin also inhibited the proliferation of the *P. falciparum* 3D7 strain at IC_{50} of 44.6 μM, and inhibited *Pf*MQO at IC_{50} of 51 μM. We did not further investigate the inhibitory mechanism of nornidulin against the proliferation of *P. falciparum* cell, but we found that the extract of *Aspergillus* sp. BioMCC f.T.8501 culture broth did not inhibit the *Pf*DHODH enzymatic reaction (data not shown). Therefore, we assumed that nornidulin inhibited the proliferation of *P. falciparum* cell by inhibiting *Pf*MQO specifically.

We also assessed the cytotoxicity of nornidulin against the DLD-1 and Vero cell lines. The compound did not affect the proliferation of the two cell lines at the highest concentration (466 μM), resulting in a selectivity index of more than 10. However, we observed hemolysis of RBC used in *p*LDH assay at this concentration (data not shown), indicating that RBC might be more sensitive to nornidulin compared to the tested mammalian cell lines.

In a previous study, systematic investigation was carried out to assess the cytotoxicity of phenolic polyketides from *Aspergillus unguis* against six cancer cell lines. Most of the isolated compounds showed cytotoxicity against all tested cell lines, with IC_{50} values ranging from 2.5 to 46.9 μM [21]. Another study isolated and characterized four new diphenyl ethers, Aspergillus ether GJ, and a new depsidone, emeguisin D, together with 18 known compounds from the endophyte *Aspergillus unguis* BCC54176. All of these components showed antibacterial activity, but none of these compounds were cytotoxic to cancer cells (MCF-7 and NCI-H187) and non-cancer cells (Vero) [14]. Since we did not observe cytotoxicity of nornidulin, we learned that not all depsidone derivatives exhibited cytotoxicity against mammalian cells.

4. Materials and Methods

4.1. Ethical Approval

This study was approved by the administration of the Health Research Ethics Committee (HREC), Faculty of Medicine, Universitas Brawijaya, Malang, East Java, Indonesia.

4.2. Microbial Extract Preparation

A total of 1600 microbial extracts, composed from 800 actinomycetes and 800 fungi extracts each, were prepared using an Indonesia-originated microbial strain collection deposited at the Biotech Center-BPPT Microbial Culture Collection of the National Research and Innovation Agency (BRIN). All microbes were revived from cryopreserved stocks on a

malt extract agar (MEA) medium (2% malt extract, 2% glucose, 0.1% peptone, and 2% agar) for fungi, or International Streptomyces Project 4 (ISP 4) medium (1% soluble starch, 0.1% $MgSO_4$.7H2O, 0.1% NaCl, 0.2% $(NH_4)_2SO_4$, 0.25% $CaCO_3$, and 2% agar) for actinomycetes. Actinomycetes were cultured in 2 types of media: C medium (2% rice powder, 1% glucose, 2% soybean meal, 0.5% yeast extract, 0.25% NaCl, 0.32% $CaCO_3$, 0.2% mineral solution, pH 7.4) and A21 medium (0.5% glucose, 0.2% tryptone, 0.4% $CaCO_3$, 0.2% NaCl, 0.05% KH_2PO_4, pH 7.0). Fungi were cultured in 4 types of media: F medium (2% rice powder, 1% glucose, 2% soybean meal, 0.1% KH_2PO4, 0.05% $MgSO_4.7H_2O$), F15 medium (3% glucose, 2% glycerol, 1% dextrin, 1% malt extract, 2% yeast extract, 0.1% tryptone, 0.1% NH_4NO_4, 0.1% KH_2PO_4, pH 6.5), F2 medium (2% malt extract, 1.1% glucose, 0.22% yeast extract, 0.05% K_2HPO_4, 0.01% $MgSO_4.7H_2O$, 0.001% $FeCl_4$, 0.000178% $ZnSO_4$, 0.00055% CaCl), and F4 medium (0.5% malt extract, 1% glucose, 4% dextrin, 0.05% K_2HPO_4, 0.5% polypeptone, 0.5% soybean meal, 0.2% yeast extract, pH 6.0). Each strain was cultured in 50 mL medium in a 250 mL Erlenmeyer flask and shaken in a rotary shaker at 220 rpm and 28 °C for 7 days. The microbial culture broth was extracted by an equal volume of butanol and dried up in a vacuum centrifugal concentrator. The dried extract was dissolved in dimethyl sulfoxide (DMSO), so the extract was concentrated 25 times compared to its initial volume.

4.3. PfMQO Assay

*Pf*MQO enzyme was prepared using *Pf*MQO-expressing recombinant *Escherichia coli,* as described by Hartuti et al. (2018) [11]. The principle of the *Pf*MQO assay is shown in Figure 2a. An assay mix solution was prepared from 50 mM HEPES-KOH (pH 7.5), 1 mM KCN, 60 µM decylubiquinone, 120 µM DCIP (blue), and 3 µg of *Pf*MQO-membrane fraction. Further, 193 µL of the assay mix was transferred to a 96-well microplate, and 2 µL of microbial extract was added. The reaction was started by the addition of 5 µL of 400 mM sodium-*L*-malate (Wako) and subsequently mixed using a plate mixer (800–1000 rpm) for 30 seconds. The absorbance of the mixture was recorded by a SpectraMax®® Paradigm®® multi-mode multiplate reader (Molecular Devices, California, USA). The inhibitory activity was calculated using a formula, as described in Figure 2b. The reaction mixture without the addition of the substrate and microbial extract was regarded as the positive control (PC) and negative control (NC), respectively.

The performance of the screening system was evaluated by calculating the statistical parameter, z'factor, with the following Equation [22]

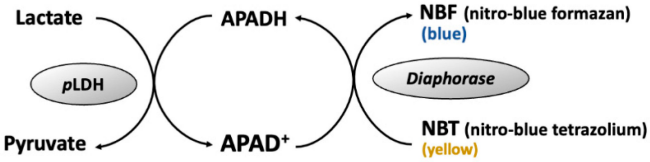
$$z'\text{factor} = 1 - \frac{3\text{SD of PC} + 3\text{SD of NC}}{|\text{mean of PC} - \text{mean of NC}|}$$

where SD is the standard deviation; PC is the positive control; and NC is the negative control.

4.4. Lactate Dehydrogenase (pLDH) Assay

The principle of *p*LDH assay is shown in Figure 12a. Red blood cell (RBC) type O+ was obtained from the local Red Cross. *P. falciparum* 3D7 was maintained in a RPMI-1640 medium (supplemented with Albumax II (Gibco-Thermo Fisher Scientific, Waltham, MA, USA), and contained RBC (3% hematocrit). *P. falciparum* cell was synchronized into the ring form stage using 5% sorbitol, and then adjusted so the parasitemia was 0.3%. The sample was added to 96-well microplate, followed by the addition of 100 µL of the *P. falciparum* cell culture. The cell was incubated for 3 days at 37 °C, 5% CO_2, 5% O_2. Cold PBS was added to the cell culture, as much as 200 µL, then centrifuged at 1700× *g* for 10 min. After discarding the supernatant, 100 µL of LDH reaction mixture (100 mM Tris-HCl pH 8.0, 50 mM sodium-*L*-lactate, 0.25% (*v*/*v*) Triton X-100), 0.2% nitro blue tetrazolium (NBT), 50 µg/mL 3-acetyl pyridine NAD (APAD), and 0.05 U diaphorase) was added into each well and incubated at 37 °C for 30 min before the absorbance was measured at 650 nm using a microplate reader. Inhibition activity was calculated using formula in Figure 12b.

Cell cultures with the addition of DMSO (final concentration 0.4%) and atovaquone (final concentration 1 μM) were regarded as negative and positive controls, respectively.



(**a**)

$$\%\ inhibition = 100 - \left[\left(\frac{sample - positive\ control}{negative\ control}\right) \times 100\ \%\right]$$

(**b**)

Figure 12. Principle of *p*LDH assay. (**a**) *p*LDH assay reaction, (**b**) formula for calculating the inhibitory activity of the proliferation of *P. falciparum* cell. Sample, A_{650nm}, of reaction mixture with the presence of sample; positive control, A_{650nm}, of reaction mixture with the presence of 1 μM atovaquone; negative control, A_{650nm}, of reaction mixture with the presence of 0.4% DMSO.

4.5. Preliminary Extraction Test

A small part (1–5 mL) of microbial culture broth was centrifuged to separate the mycelium from the supernatant. The mycelium was extracted by methanol. A part of the supernatant was extracted by butanol or ethyl acetate under different pH levels (2 and 8), then centrifuged at 10,000× *g* for 10 min to separate the solvent and water layer. The other part of the supernatant was heated at 60 °C for 1 h under pH 2, 7 or 9, then centrifuged at 10,000× *g* for 10 min. All samples were subjected to the *Pf*MQO assay.

4.6. Thin Layer Chromatography (TLC)

TLC was carried out on a silica TLC plate (Merck, Darmstadt, Germany) in a glass chamber containing organic solvent (as described in the text). The spot on the TLC plate was visualized under UV light or by spraying phosphomolybdic acid.

4.7. Open Column Chromatography (OCC)

The dried extract was mixed with silica gel 60 F_{254} resin (0.063–0.040 mm, Merck, Darmstadt, Germany), then loaded into a glass column (4 cm diameter, 40 cm length). Compounds from the extract were eluted by a mixed solvent of chloroform ($CHCl_3$) and methanol (CH_3OH) step wisely (100% $CHCl_3$, 90% $CHCl_3$: 10% CH_3OH, 80% $CHCl_3$: 20% CH_3OH, 50% $CHCl_3$: 50% CH_3OH, 100% CH_3OH), and the eluted solvent was collected using a fraction collector. A small part of these fraction was dried up in a vacuum concentrator, dissolved in DMSO, and then subjected to the *Pf*MQO assay.

4.8. Analytical and Semi-Preparative HPLC

Analytical HPLC was performed using the Prominence modular HPLC system equipped with an SPD-M30A photodiode array detector and an LC-20A dual channel solvent delivery pump (Shimadzu, Kyoto, Japan). In total. 10 μL of the sample was separated in a C_{18} Sunfire® OBD Column 100A (2.5 μm particle size, 10 mm diameter, 250 mm length, Waters, MI, USA), and eluted with a mixed water—acetonitrile (A—B) solvent (containing 0.05% trifluoroacetic acid) at a flow rate of 1 mL/min under the conditions below: flow 40% A for the first 20 min, increase to 100% A for the next 10 min, then decrease to 40% A for 5 min.

Semi-preparative HPLC was performed using the Prominence modular HPLC system equipped with a SPD-20A UV detector and an LC-20A dual channel solvent delivery pump (Shimadzu, Kyoto, Japan). In total, 100 μL of the sample was injected into a C_{18} Sunfire®OBD Prep column 100A (5 μm particle size, 10 mm diameter, 250 mm length, Waters, MI, USA), and eluted with mixed water—acetonitrile (A—B) solvent (containing 0.05% trifluoroacetic acid) at a flow rate of 4 mL/min for 55 min under the conditions below: flow 40% A for the first 20 min, increase to 100% A for the next 30 min, then decrease to 40% A for 5 min.

4.9. LC-MS Analysis

LC-MS analysis was performed using a HPLC system (Dionex Ultimate 3000 RSC, Thermo Fisher Scientific, MA, USA) connected with a high-resolution mass spectrometer Q-Exactive (Thermo Fisher Scientific, MA, USA). In total, 100 µL of the sample was injected into the HPLC equipped with Hypersil GOLD aQ C_{18} polar-endcapped HPLC column (50 mm length, 1 mm diameter, 1.9 µl particle size, Thermo Fisher Scientific, MA, USA) and eluted with a mixed water—acetonitrile (A—B) solvent (both containing 0.1% formic acid at flow rate 40 µL/min for 30 min) under the conditions below: flow 5% B for the first 2 min, then increase to 60% B for 13 min, further increase to 95% B for the next 7 min before keeping at this concentration for 3 min, then decrease and keep at 5% B for 5 min. The sample was detected by MS (full scan at 70.000 resolution) and MS^2 (data dependent at 17,500 resolutions). Data were processed with compound discoverer software using mzCloud MS/MS library version 3.2.

4.10. Cytotoxicity of Bioactive Compound on Mammalian Cells

Human colorectal adenocarcinoma cells (DLD-1) and the kidney of an African green monkey cell derived (Vero) were cultured in Dulbecco's Modified Eagle Medium (DMEM, Gibco-Thermo Fisher Scientific, MA, USA) supplemented with 10% of inactivated fetal bovine serum (Gibco-Thermo Fisher Scientific, MA, USA). The cells were transferred to a 96-well microplate, so the initial cell number was 1.25×10^4 cells 5×10^3 cells for DLD-1 and Vero, respectively, per well, then incubated at 37 °C, 5% CO_2 for 24 h. The sample was added as much as 0.4 µL or a volume so the final concentration of DMSO in the culture was less than 1%, then incubated at 37 °C, 5% CO_2 for 48 h. After being washed with 100 µL of PBS, the cell was resuspended with 100 µL of DMEM containing 10% of Cell Counting Kit-8 (Dojindo, Kumamoto, Japan) and placed in the incubator at 37 °C, 5% CO_2 for 3 h. The absorbance of each well was measured at 450 nm by a plate reader (Spectramax Paradigm, Molecular Devices, San Jose, CA, USA).

5. Conclusions

In this study, we reported nornidulin as microbe-derived inhibitor of *Pf*MQO for the first time. We also demonstrated that nornidulin inhibited the proliferation of *P. falciparum* 3D7 strains, but not DLD-1 and Vero cell lines with a selectivity index of more than 10. Since we isolated nornidulin from an Indonesia-originated soil fungus, *Aspergillus* sp. BioMCC f.T.8501, we also emphasized the potential of Indonesian microbial strains as a promising source for anti-malarial drug discovery.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ph16020268/s1, Figure S1: Morphology of *Aspergillus* sp. BioMCC f.T.8501, macroscopic form of the fungus on MEA medium; Figure S2: Morphology of *Aspergillus* sp. BioMCC f.T.8501, Microscopic shape the conidiophore; Figure S3: Thin layer chromatography of active fractions (Fr2-Fr8) from silica gel column chromatography.

Author Contributions: Conceptualization, A.W.C., L.E.F. and E.E.P.; methodology, A.W.C., L.E.F., S.W., E.E.P., D.W. and S.S.; software, A.W.C. and N.N.; validation, L.E.F. and T.N.; formal analysis, A.W.C., L.E.F., S.W. and E.E.P., investigation, A.W.C. and A.P.; resources, A.P., E.C., D.D., N.B.N. and E.S.; data curation, A.W.C., E.E.P. and S.S.; writing—original draft preparation, A.W.C.; writing—review and editing, A.W.C., L.E.F., E.E.P. and D.W.; supervision, T.N., E.E.P., L.E.F., D.W., A.P., E.S. and E.C.; project ad-ministration, N.B.N.; funding acquisition, L.E.F., D.W. and T.N. All authors have read and agreed to the published version of the manuscript.

Funding: This work was partly funded by a grant from the Program Magister Menuju Doktor Sarjana Unggul from The Ministry of Education, Culture, Research, and Technology of 2021 to Brawijaya University, Doctoral and Professor Research Grants from the Faculty of Medicine of Universitas Brawijaya of 2022, and a grant from the Science and Technology Research Partnership for Sustainable Development (SATREPS) from the Japan Agency for Medical Research and Development (AMED) to

the University of Tokyo and from Japan International Cooperation Agency (JICA) to the National Research and Innovation Agency (BRIN).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data is contained within the article and supplementary material.

Acknowledgments: The authors would like to thank to The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia and the Faculty of Medicine, Universitas Brawijaya for providing the research grant. We also thank the Laboratory for Biotechnology, National Research and Innovation Agency (BRIN), BJ Habibie Science and Technology Park, South Tangerang-Banten, Indonesia for their research facilities.

Conflicts of Interest: The authors declare no conflict of interest in this work.

References

1. World Health Organization. *World Malaria Report: 20 Years of Global Progress and Challenges*; WHO: Geneva, Switzerland, 2020; ISBN 978-92-4-001579-1.
2. Kumar, S.; Bhardwaj, T.R.; Prasad, D.N.; Singh, R.K. Drug targets for resistant malaria: Historic to future perspectives. *Biomed. Pharmacother.* **2018**, *104*, 8–27. [CrossRef] [PubMed]
3. Tse, E.G.; Korsik, M.; Todd, M.H. The Past, Present and Future of Anti-Malarial Medicines. *Malar. J.* **2019**, *18*, 93. [CrossRef] [PubMed]
4. WHO. *World Malaria Report 2018*; WHO: Geneva, Switzerland, 2018; ISBN 9789241565653.
5. Van der Pluijm, R.W.; Tripura, R.; Hoglund, R.M.; Pyae Phyo, A.; Lek, D.; ul Islam, A.; Anvikar, A.R.; Satpathi, P.; Satpathi, S.; Behera, P.K.; et al. Triple artemisinin-based combination therapies versus artemisinin-based combination therapies for uncomplicated Plasmodium falciparum malaria: A multicentre, open-label, randomised clinical trial. *Lancet* **2020**, *395*, 1345–1360. [CrossRef] [PubMed]
6. Kokkonda, S.; El Mazouni, F.; White, K.L.; White, J.; Shackleford, D.M.; Lafuente-Monasterio, M.J.; Rowland, P.; Manjalanagara, K.; Joseph, J.T.; Garcia-Pérez, A.; et al. Isoxazolopyrimidine-Based Inhibitors of Plasmodium falciparum Dihydroorotate Dehydrogenase with Antimalarial Activity. *ACS Omega* **2018**, *3*, 9227–9240. [CrossRef] [PubMed]
7. Llanos-Cuentas, A.; Casapia, M.; Chuquiyauri, R.; Hinojosa, J.C.; Kerr, N.; Rosario, M.; Toovey, S.; Arch, R.H.; Phillips, M.A.; Rozenberg, F.D.; et al. Antimalarial activity of single-dose DSM265, a novel plasmodium dihydroorotate dehydrogenase inhibitor, in patients with uncomplicated Plasmodium falciparum or Plasmodium vivax malaria infection: A proof-of-concept, open-label, phase 2a study. *Lancet Infect. Dis.* **2018**, *18*, 874–883. [CrossRef] [PubMed]
8. Wang, X.; Miyazaki, Y.; Inaoka, D.K.; Hartuti, E.D.; Watanabe, Y.-I.I.; Shiba, T.; Harada, S.; Saimoto, H.; Burrows, J.N.; Benito, F.J.G.; et al. Identification of Plasmodium falciparum Mitochondrial Malate: Quinone Oxidoreductase Inhibitors from the Pathogen Box. *Genes* **2019**, *10*, 471. [CrossRef] [PubMed]
9. Flannery, E.L.; Chatterjee, A.K.; Winzeler, E.A. Antimalarial drug discovery—Approaches and progress towards new medicines. *Nat. Rev. Microbiol.* **2017**, *15*, 572. [CrossRef] [PubMed]
10. Ke, H.; Ganesan, S.M.; Dass, S.; Morrisey, J.M.; Pou, S.; Nilsen, A.; Riscoe, M.K.; Mather, M.W.; Vaidya, A.B. Mitochondrial type II NADH dehydrogenase of Plasmodium falciparum (PfNDH2) is dispensable in the asexual blood stages. *PLoS ONE* **2019**, *14*, e0214023. [CrossRef] [PubMed]
11. Hartuti, E.D.; Inaoka, D.K.; Komatsuya, K.; Miyazaki, Y.; Miller, R.J.; Xinying, W.; Sadikin, M.; Prabandari, E.E.; Waluyo, D.; Kuroda, M.; et al. Biochemical studies of membrane bound Plasmodium falciparum mitochondrial L-malate:quinone oxidoreductase, a potential drug target. *Biochim. Biophys. Acta Bioenerg.* **2018**, *1859*, 191–200. [CrossRef] [PubMed]
12. Waluyo, D.; Prabandari, E.E.; Pramisandi, A.; Hidayati, D.N.; Chrisnayanti, E.; Puspitasari, D.J.; Dewi, D.; Suryani; Kristiningrum; Oktaviani, A.N.; et al. Exploring natural microbial resources for the discovery of anti-malarial compounds. *Parasitol. Int.* **2021**, *85*, 102432. [CrossRef] [PubMed]
13. Ishiyama, A.; Iwatsuki, M.; Namatame, M.; Nishihara-Tsukashima, A.; Sunazuka, T.; Takahashi, Y.; Ömura, S.; Otoguro, K. Borrelidin, a potent antimalarial: Stage-specific inhibition profile of synchronized cultures of Plasmodium falciparum. *J. Antibiot.* **2011**, *64*, 381–384. [CrossRef] [PubMed]
14. Sadorn, K.; Saepua, S.; Bunbamrung, N.; Boonyuen, N.; Komwijit, S.; Rachtawee, P.; Pittayakhajonwut, P. Diphenyl ethers and depsidones from the endophytic fungus Aspergillus unguis BCC54176. *Tetrahedron* **2022**, *105*, 132612. [CrossRef]
15. Pramisandi, A.; Dobashi, K.; Mori, M.; Nonaka, K.; Matsumoto, A.; Tokiwa, T.; Higo, M.; Kristiningrum; Amalia, E.; Nurkanto, A.; et al. Microbial inhibitors active against plasmodium falciparum dihydroorotate dehydrogenase derived from an indonesian soil fungus, talaromyces pinophilus biomcc-f.T.3979. *J. Gen. Appl. Microbiol.* **2020**, *66*, 273–278. [CrossRef] [PubMed]
16. Dean, F.M.; Roberts, J.C.; Robertson, A. The chemistry of fungi. Part XXII. Nidulin and nornidulin ("ustin"): Chlorine-containing metabolic products of Aspergillus nidulans. *J. Chem. Soc.* **1954**, 1432–1439. [CrossRef]
17. Beach, W.F.; Richards, J.H. The Structure and Biosynthesis of Nidulin. *J. Org. Chem.* **1963**, *28*, 2746–2751. [CrossRef]

18. Yang, W.C.; Bao, H.Y.; Liu, Y.Y.; Nie, Y.Y.; Yang, J.M.; Hong, P.Z.; Zhang, Y. Depsidone derivatives and a cyclopeptide produced by marine fungus aspergillus unguis under chemical induction and by its plasma induced mutant. *Molecules* **2018**, *23*, 2245. [CrossRef] [PubMed]
19. Ten, L.; Domingos, S.; Martins, S.; Lima, L.M. De Secondary Metabolites Diversity of Aspergillus unguis and Their Bioactivities: A Potential Target to Be Explored. *Biomolecules* **2022**, *12*, 1820. [CrossRef]
20. Blunt, J.W.; Copp, B.R.; Keyzers, R.A.; Munro, M.H.G.; Prinsep, M.R. Marine natural products. *Nat. Prod. Rep.* **2014**, *31*, 160–258. [CrossRef] [PubMed]
21. Van Anh, C.; Kwon, J.H.; Kang, J.S.; Lee, H.S.; Heo, C.S.; Shin, H.J. Antibacterial and Cytotoxic Phenolic Polyketides from Two Marine-Derived Fungal Strains of Aspergillus unguis. *Pharmaceuticals* **2022**, *15*, 74. [CrossRef] [PubMed]
22. Zhang, J.H.; Chung, T.D.; Oldenburg, K.R. A Simple Statistical Parameter for Use in Evaluation and Validation of High Throughput Screening Assays. *J. Biomol. Screen.* **1999**, *4*, 67–73. [CrossRef] [PubMed]

Source details

Pharmaceuticals

Open Access

Scopus coverage years: 2004, from 2009 to Present

Publisher: Multidisciplinary Digital Publishing Institute (MDPI)

ISSN: 1424-8247

Subject area: Pharmacology, Toxicology and Pharmaceutics: Pharmaceutical Science

Pharmacology, Toxicology and Pharmaceutics: Drug Discovery

Biochemistry, Genetics and Molecular Biology: Molecular Medicine

Source type: Journal

CiteScore 2021
4.0

SJR 2021
0.851

SNIP 2021
1.223

View all documents > | Set document alert | Save to source list

CiteScore | CiteScore rank & trend | Scopus content coverage

Improved CiteScore methodology

CiteScore 2021 counts the citations received in 2018-2021 to articles, reviews, conference papers, book chapters and data papers published in 2018-2021, and divides this by the number of publications published in 2018-2021. Learn more >

CiteScore 2021

$$4.0 = \frac{8{,}414 \text{ Citations } 2018 - 2021}{2{,}126 \text{ Documents } 2018 - 2021}$$

Calculated on 05 May, 2022

CiteScoreTracker 2022

$$4.8 = \frac{16{,}674 \text{ Citations to date}}{3{,}508 \text{ Documents to date}}$$

Last updated on 05 March, 2023 • Updated monthly

CiteScore rank 2021

Category	Rank	Percentile
Pharmacology, Toxicology and Pharmaceutics — Pharmaceutical Science	#75/171	56th
Pharmacology, Toxicology and Pharmaceutics — Drug Discovery	#85/154	45th

View CiteScore methodology > | CiteScore FAQ > | Add CiteScore to your site

Display only Open Access journals

Counts for 4-year timeframe

No minimum selected

Minimum citations

Minimum documents

Citescore highest quartile

Show only titles in top 10 percent

1st quartile

2nd quartile

3rd quartile

4th quartile

Source type

Journals

Book Series

Conference Proceedings

1	Pharmaceuticals *Open Access*	4.0	56% 75/171 Pharmaceutical Science	8,414	2,126	61
2	Journal of Pharmacy and Pharmacognosy Research *Open Access*	1.6	54% 17/36 Pharmacy	338	213	55
3	Research Journal of Pharmacy and Technology	1.3	58% 13/30 Pharmacology, Toxicology and Pharmaceutics (miscellaneous)	4,996	3,865	40

Top of page

Pharmaceuticals

COUNTRY

Switzerland

Universities and research institutions in Switzerland

Media Ranking in Switzerland

SUBJECT AREA AND CATEGORY

Biochemistry, Genetics and Molecular Biology
- Molecular Medicine

Pharmacology, Toxicology and Pharmaceutics
- Drug Discovery
- Pharmaceutical Science

PUBLISHER

Multidisciplinary Digital Publishing Institute (MDPI)

H-INDEX

69

PUBLICATION TYPE

Journals

ISSN

14248247

COVERAGE

2009-2021

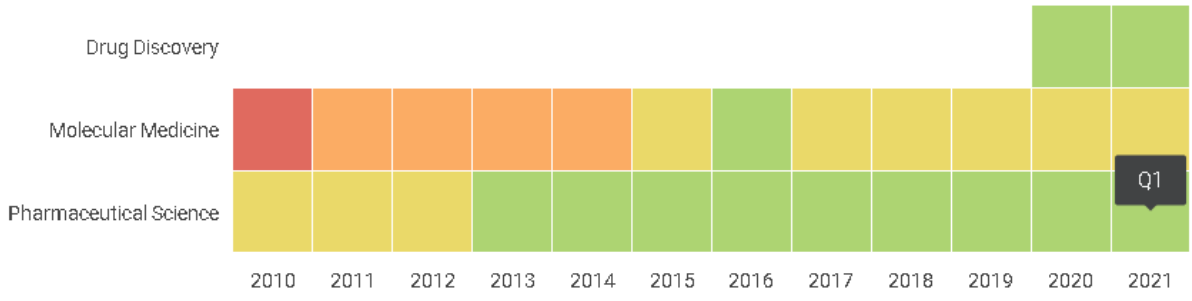
INFORMATION

Homepage

How to publish in this journal

Jean-Jacques.VANDENEYNDE@ex.umons.ac.be

Quartiles



SJR

2013	0.590
2014	0.765
2015	1.273
2016	1.553
2017	1.293
2018	1.209
2019	1.245
2020	1.295
2021	0.851

Total Documents