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The importance of digital resources in STEM research and education: the role of librarians

Marguerite Nel

2 March 2023

Make today matter

Introduction



University of Pretoria

UP has 9 Faculties & 1 business school



EDUCATION



HUMANITIES



LAW



HEALTH SCIENCES



THEOLOGY AND RELIGION



VETERINARY SCIENCE



ECONOMIC AND MANAGEMENT SCIENCES



NATURAL AND AGRICULTURAL SCIENCES



ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY



GORDON INSTITUTE OF BUSINESS SCIENCE (GIBS)

4	51
Centres of Excellence	Research Chairs
1 175	120
Study programmes	Academic departments
145	
Undergraduate programmes	
72	237
Research Institutes and Centres	Degrees, certificates and diplomas

A WORLD-CLASS UNIVERSITY

#48

Mineral and Mining Engineering*

#49

Veterinary Science**

#60

Law*

* Universal Ranking by Academic Performance (URAP) for subjects
 ** 2020 QS World University Rankings and Shanghai Rankings

GIBS named top business school in Africa for executive education¹



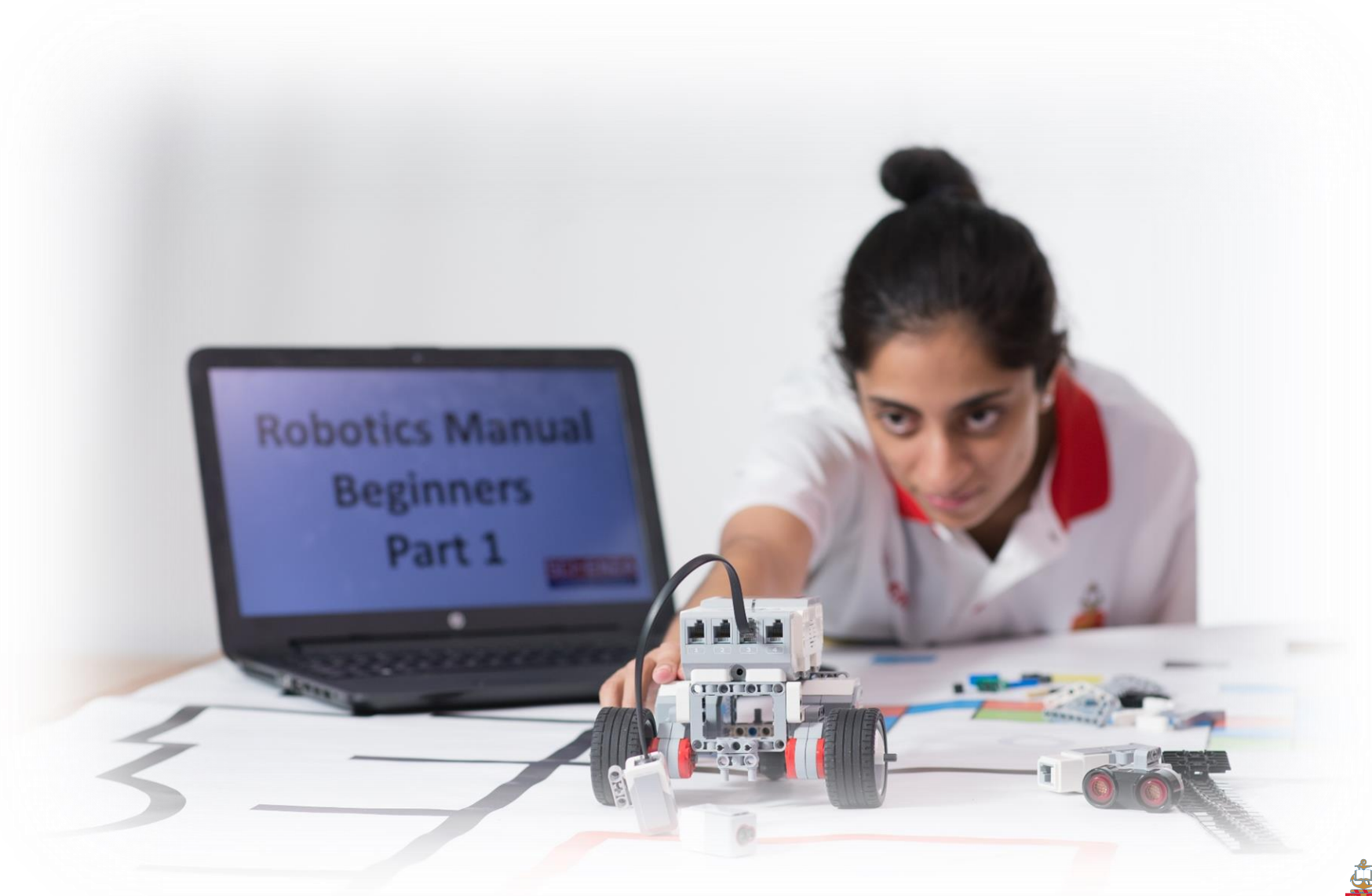
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University of Pretoria Libraries

- Merensky 2 Library
 - Economic & Management Sciences
 - Engineering, Built Environment and Information Technology
 - Natural & Agricultural Sciences
 - Humanities
 - Theology
- Oliver R. Tambo Law Library
- Music Library
- Education Library
- Mamelodi Library
- Health sciences
 - Basic Medical Science & Dentistry Library
 - Medical Library
 - Klinikala Library located at Kalafong Hospital
- Jotello F Soga Veterinary Science Library







Overview

21st Century Science, Technology, Engineering and Mathematics (STEM) environments



Researchers



Students

- Information behaviour
- Why are digital resources important?

Best practices and opportunities for librarians who support STEM faculties



STEM research environments

...to solve the world's greatest challenges...

- Interdisciplinary collaboration
- Big data and artificial intelligence
- Sustainability and environmental science
- Diversity, equity, and inclusion
- Open science and reproducibility
- Entrepreneurship and innovation
- Ethics and responsible conduct



Information behaviour and resource preferences

...the diversity and complexity of information needs ...

- Information seeking:
 - Time and convenience are important considerations when selecting and using information resources (Connaway et al., 2011)
 - Trustworthiness and credibility of information resources are important (Ford, 2019)
- Information usage:
 - Preference for digital resources (Balog et al., 2018; Gordon et al., 2018; Keil, 2014)
 - Prefer e-books (use books in e-book packages, e.g., Access engineering, Knovel) (Carrico et al., 2015)
 - Evidence-based, reproducible research using the scientific method (Theobald et al., 2020)
 - Require access to a broad range of information sources and data, such as specialized technical information, standards, research findings, and cutting-edge technological innovations (Jung Mi, 2021; Kaufman et al., 2019; Kvenild et al., 2017)
- Information sharing
 - Collaboration and networking (Kvenild et al., 2017; Wilson, 2017)
 - Use of data management and visualization tools (Keil, 2014)
 - Open science and open access publishing (Williams & Kerby, 2017)
- Embraces technology and opportunities provided by the fourth industrial revolution (4IR)) (Kvenild et al., 2017)
- Do not use the library for books (Wilson, 2017)!



Learning environment of STEM students

... it's more than just learning... it's and experience...

- Integration of technology in teaching and learning
- Active learning, innovation and hands-on learning experiences
- Interdisciplinary education
- Diversity, equity, and inclusion
- Collaborative learning
- Soft skill development
- Personalized learning



Information behaviour and resource preferences

... not the typical library user...

- Preference for digital resources (Balog et al., 2018; Gordon et al., 2018; Keil, 2014)
- Prefer specialized resources that are relevant to their subject area (Theobald et al., 2020)
- Often use advanced search strategies (Liyana & Noorhidawati, 2017; Mercer et al., 2019)
- Often deal with large datasets and require specialized software tools to manage them (Theobald et al., 2020)
- Only visit the library for a specific purpose (Wilson, 2017)
 - Study
 - Makerspace and technology
- Integration of technology in learning (Vahidy, 2019; Wilson, 2017)



Importance of digital resources

- Convenience and time
- Trustworthiness and credibility
- Speed of finding and sharing information
- Access to a variety of information resources
- Access to data, data repositories
- Open science, open access and other open educational resources (OERs)





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Importance of digital resources (continue)

- Value added and interactive features of resources
 - Simplify difficult concepts
 - Explain methods
 - Guide decisions
 - Address different learning styles
 - Personalized features (recommendations, search history, alerts)
 - Integration with other systems (e.g., Learning Management System)
 - Enabling people with disabilities to access
 - Statistics and usage reports

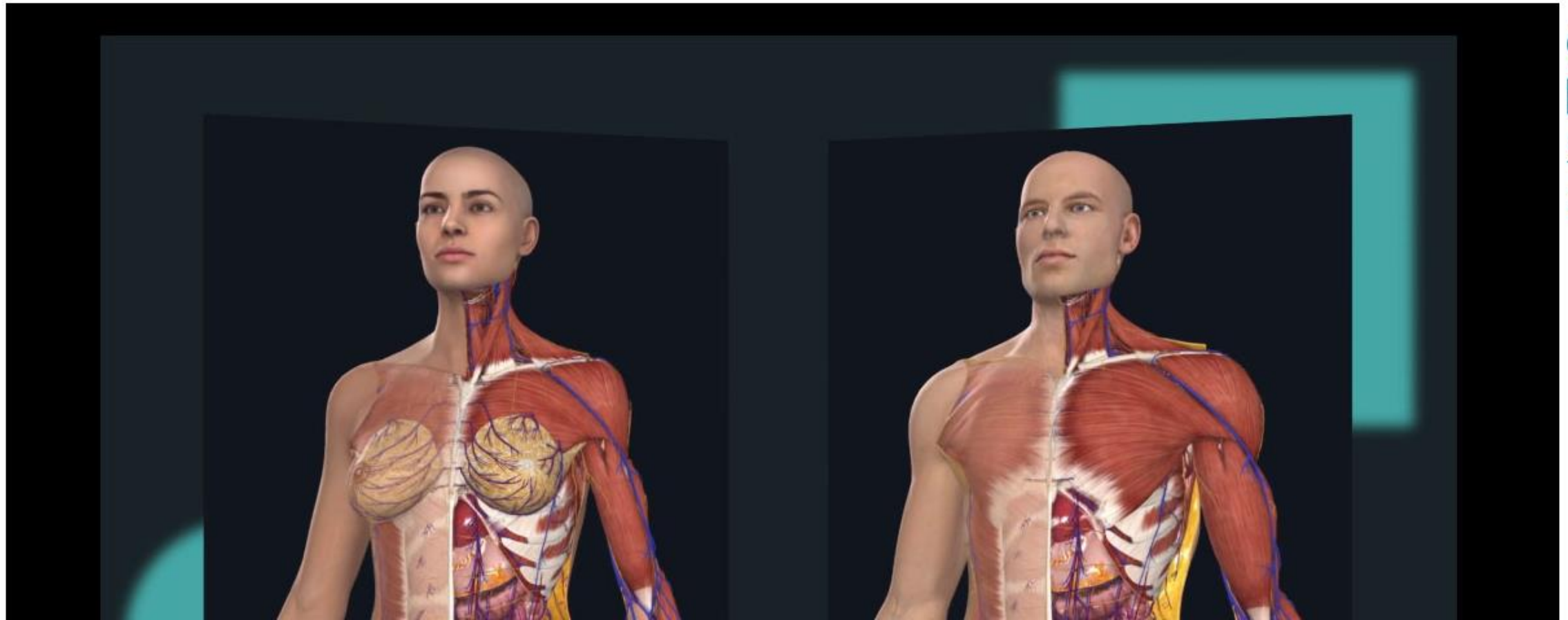




Together we created the most advanced 3D female anatomy model

The team behind 3D4Medical's female anatomy model talks about how they developed it — and why it has far-reaching implications for medicine

By [Terri Mueller](#) - April 1, 2022



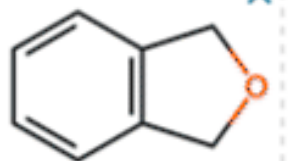
97

Filters

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Preview



As drawn

Yield



Reagent/Catalyst



Solvent



Catalyst Classes



Solvent Classes



Product Availability



Reactant Availability



Reaction Classes



Document Type



Publication Year

 Single step reactions only Experimental procedure only

97 Reactions out of 62 Documents, containing 96 Substances, 51 Targets

Reaxys - 97

 0 selected

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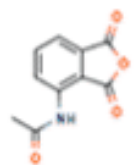
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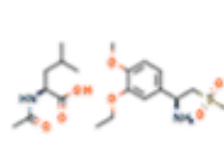
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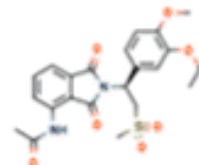
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Conditions	Yield	Reference
With triethylamine In ethyl acetate at 75 - 80°C; for 18h; Reagent/catalyst; Solvent; Experimental Procedure	95.1%	Zhejiang Huahai Pharmaceutical Co., Ltd.; Du, Xiaoqiu; Zhou, Lianchao; Liu, Jiagen CN106187857, 2016, A Location in patent: Paragraph 0014; 0026; 0027; 0028; 0029; 0030-0033 Full Text Details Abstract
With sodium acetate; acetic acid at 80°C; for 5h; Reagent/catalyst; Temperature; Experimental Procedure	91.3%	Guangzhou Aige Biological Technology Co., Ltd.; Tan Bin; Zhang Xiantao; He Shengjiang CN107188842, 2017, A Location in patent: Paragraph 0037-0044 Full Text Details Abstract
Stage #1: (S)-1-(3-ethoxy-4-methoxyphenyl)-2-(methylsulfonyl)ethanamine-(S)-2-acetamido-4-methylpentanoate With sodium hydroxide In dichloromethane at 0 - 5°C; for 2h; Stage #2: 3-acetylaminophthalic anhydride With perchloric acid; acetic acid In dichloromethane at 45°C; for 3.33333h; Reflux; Experimental Procedure	89.2%	Xinfa Pharmaceutical Industry Limited Company; Qi, Yuxin; Chen, Jun; Zhou, Lishan; Fan, Yansen; Ju, Lizhu; Li, Xinfu CN105348172, 2016, A Location in patent: Paragraph 0070; 0071; 0072 Full Text Details Abstract

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Single-cell Raman-based tool for efficient mining of live functional microbes from nature

by Li Yuan, Chinese Academy of Sciences



8



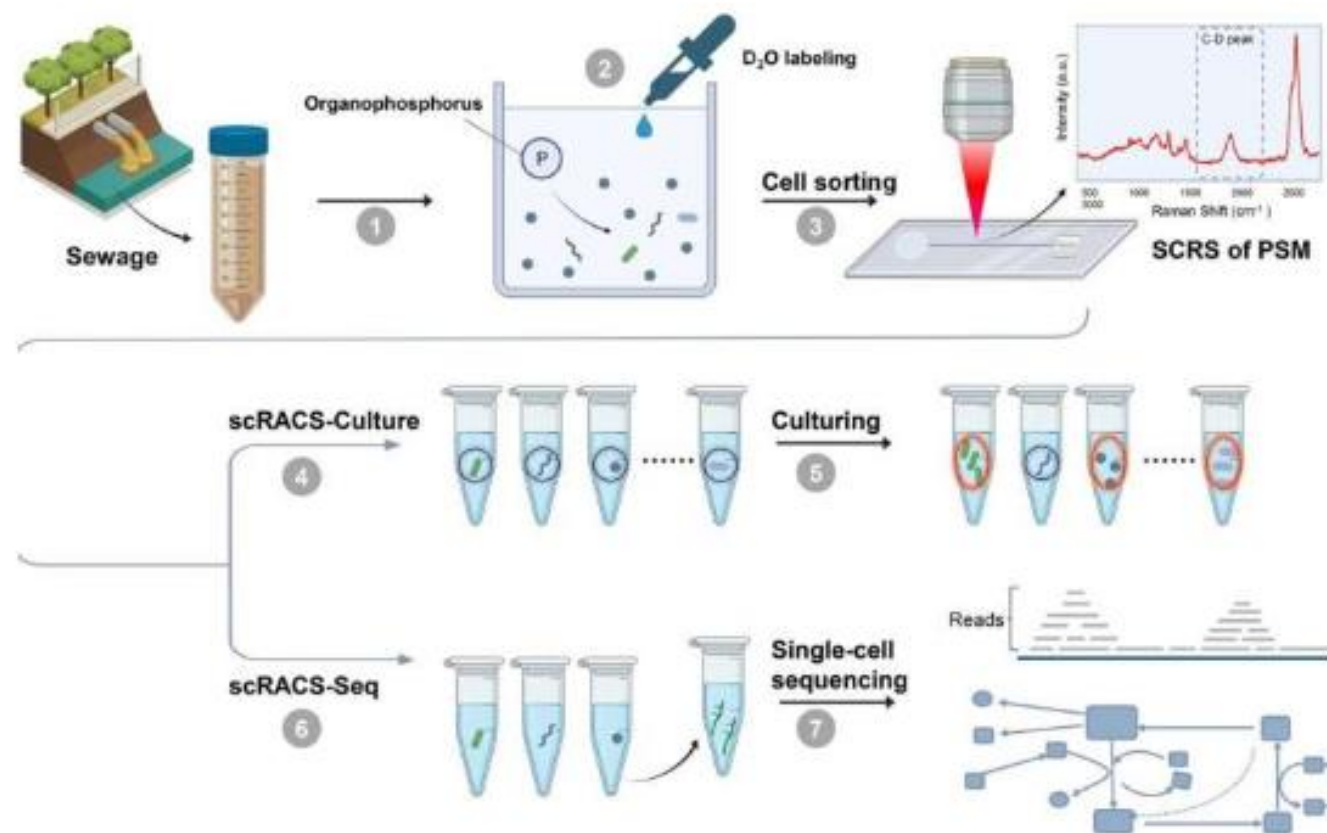
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for

semiconductor



Databases ^

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Document type v

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- EP Patents

Semiconductor alloys

Semiconductor counters

Semiconductor defects

Recommended terms: Crystal defects

Semiconductor detectors

Semiconductor device manufacture

Semiconductor device manufacture--Silicon on insulator technology*

Recommended terms: Silicon on insulator technology

Semiconductor device manufacture--Silicon on sapphire technology*

Recommended terms: Silicon on sapphire technology

Semiconductor device models

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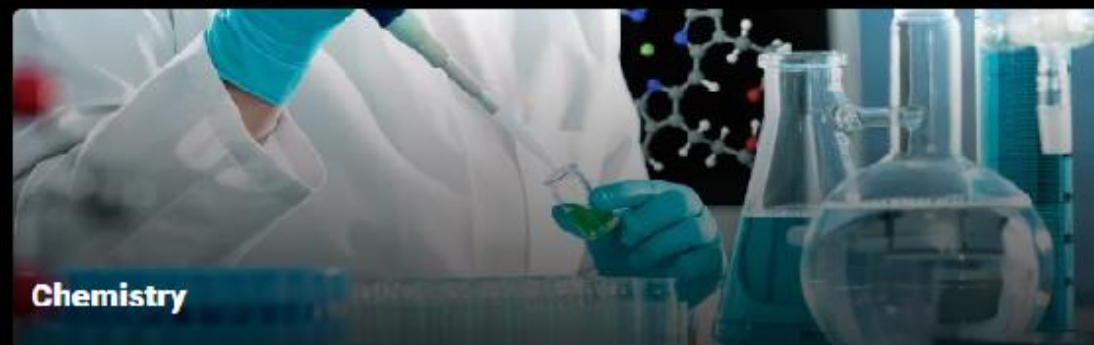
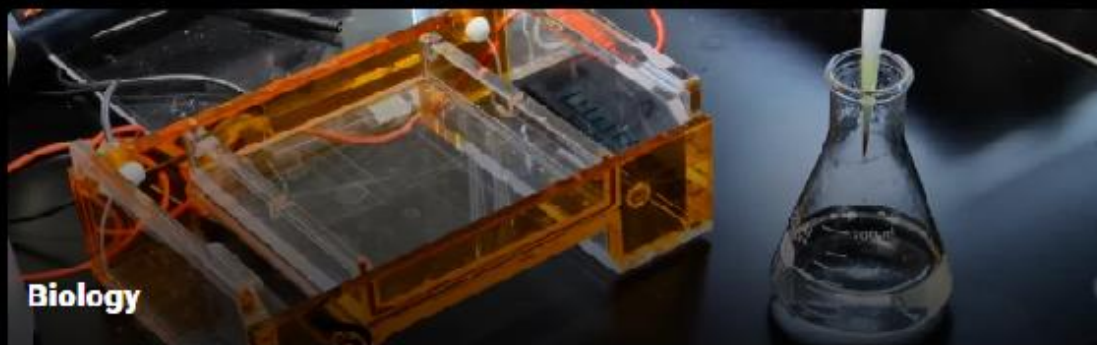
Bioenergy / Biomass Energy



Tidal Energy



All-in-one solution for teaching undergraduate lab courses through engaging, comprehensive, and curriculum-focused videos for both instructors and students.



Importance of digital resources (continue)

- Research management (e.g., Endnote, Mendeley)
- Writing management tools (e.g., Grammarly)
- Statistical software and data analysis tools (e.g., SPSS, MATLAB, R)
- Measurement of impact and research visibility (e.g., ORCID, Altmetrics, SciVal)
- Alerts and keeping up-to-date
- Learning opportunities and skills development (e.g., Coursera , LinkedIn learning)
- Collaboration and networking
- And many more!



What role can librarians play in addressing the information needs of STEM researchers and students?



Best practices and opportunities for librarians who support STEM faculties



It all starts with good relationships...

Collaborate with researchers to understand their information needs and develop customized services and resources that meet those needs.

Foster collaborations between researchers and other stakeholders, including industry, government, and the broader community, to ensure that research is translated into practical applications that benefit society.

- Embedded librarianship
- Collaboration and networking
- Awareness of the value of the library



Creating opportunities for all...

Provide products, training and education programs that help researchers develop the information and digital literacy skills they need to succeed in a rapidly changing knowledge society and technological landscape.

Assist in promoting innovation, collaboration, and responsible use of information and technology.

- Ensure diversity, equity, and inclusion in collection development practices and services
- Decrease the digital divide
- Information and digital skills development programs
- Value of subject guides



Research Guide: Research Guide Home

This Guide provides post graduate students with the tips and tools necessary to successfully complete their research.

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Welcome to the Research Guide

This Research Guide provides tips and tools for postgraduate students to complete their research.

Please see Prof McNaught's excellent presentation for an overview of the research process:

[Learning the Art of Research: Combining organizational skills, critical thinking and creative thinking by Prof. Carmel McNaught](#)

Additional sources:

- [Hatfield Research Commons](#)
- [Groenkloof Research Commons](#)
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Research Milestones

[Check your research progress in these research milestones from our latest newsletter!](#)

Thesis & Dissertation Structure

Mathematical Sciences: Subject Home

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Library Orientation

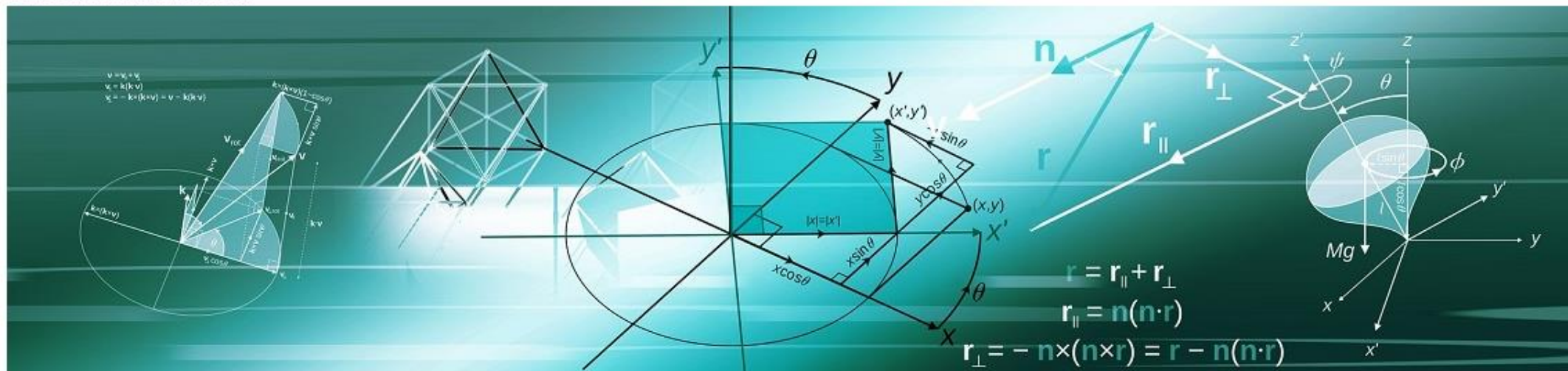
Mathematical Sciences e-Resources

Research Guide

Favourite Web-Links

Welcome

Welcome to the Mathematical Sciences subject guide. This guide will provide students, researchers and staff with access to Mathematics and Applied Mathematics, Statistics and Insurance and Actuarial Science information resources.



New e-Resources

- [JoVE Core Statistics](#)

Interesting Webinars

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Get support on the following Services

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Information Specialist



A research assistant...

Provide support to enrich research, enhance scholarly communication, and promote research excellence.

Develop and promote open access policies and repositories to increase access to scholarly publications, research data, and other valuable open resources.

- Bibliometrics, grant applications and ratings
- Systematic reviews
- Scholarly communication, open science and open access publishing
- Data, data management plans and data repositories



When they come to the library...

Provide access to emerging technologies, such as artificial intelligence, blockchain, and 3D printing, that are changing the way research is conducted and knowledge is disseminated.

- Collaborative spaces
- Technology
- Makerspaces
- Digital media labs
- Virtual reality and augmented reality
- Internet of Things (IoT) technologies





Conclusion



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Thank You



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