



Mahidol University
Faculty of Science

Stang Mongkolsuk Library
and Information Division

Stang Library Training

EndNote 21 for Macintosh



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Stang Mongkolsuk Library & Information Division

3 July 2024

Introduction

- **What is EndNote?**
- **How EndNote works**
- **Compatibility and System Requirements**
- **Download Endnote Software**

What is EndNote?

Reference management software

- Developed by [Clarivate Analytics](#)

Personal Reference database

- Storing, managing, and searching for bibliographic references in your private reference library

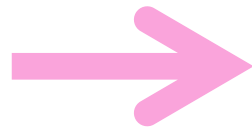
Bibliography and manuscript maker

- Formats citations in Microsoft Word with the [Cite While You Write™](#) feature

How EndNote Works



Books, Journals, Research
Articles, E-database, etc.



Create bibliography



Report, Manuscript,
Thesis, etc.

Compatibility and System Requirements

Operating System	Version	Word processor software
Windows	<ul style="list-style-type: none">• Windows 10• Windows 11	Microsoft Word [CWYW] : <ul style="list-style-type: none">• 2010• 2013• 2016• 2019• Office 365 (locally installed desktop version only)
Macintosh	<ul style="list-style-type: none">• macOS 10.14• macOS 10.15• macOS 11• macOS 12• macOS 13	Microsoft Word [CWYW] : <ul style="list-style-type: none">• 2016• 2019• Office 365 (locally installed desktop version only)

Download Endnote Software (1)

1. Go to <https://softwaredownload.mahidol.ac.th/> (Access through MU-WiFi or VPN)
2. Login with MU Internet account



1

 Mahidol University
Wisdom of the Land

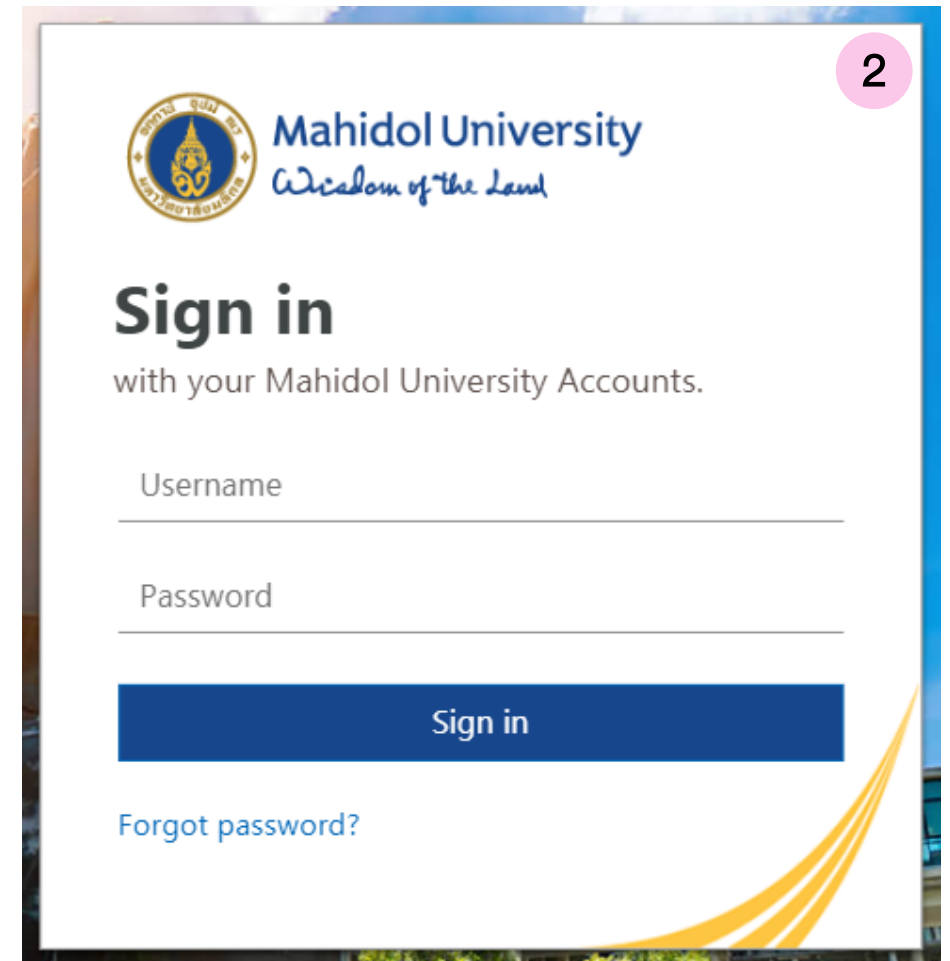
Software Download

มีดีใหม่แห่งการใช้ IT ในมหาวิทยาลัยมหิดล


มหาวิทยาลัยมหิดล มีความมุ่งมั่นที่จะส่งเสริมระบบงานด้าน IT และสมรรถนะทาง IT ให้แก่ประชาคมชาวมหิดลได้ใช้ประโยชน์อย่างทั่วถึง และมีมาตรฐานทัดเทียมกับองค์กรชั้นนำของโลก โดยได้จัดเตรียมสิทธิสำหรับ Software มาตรฐานให้บุคลากรของมหาวิทยาลัยได้ใช้งาน

[Login](#)

Microsoft Windows Microsoft Office Key License
eset Adobe MATLAB
SPSS X9 EN EndNote



2

 Mahidol University
Wisdom of the Land

Sign in

with your Mahidol University Accounts.

Username

Password

[Sign in](#)

[Forgot password?](#)

Download Endnote Software (2)

3. Download an installer compatible with your operating system. (Windows or Mac)
4. Download EndNote key license

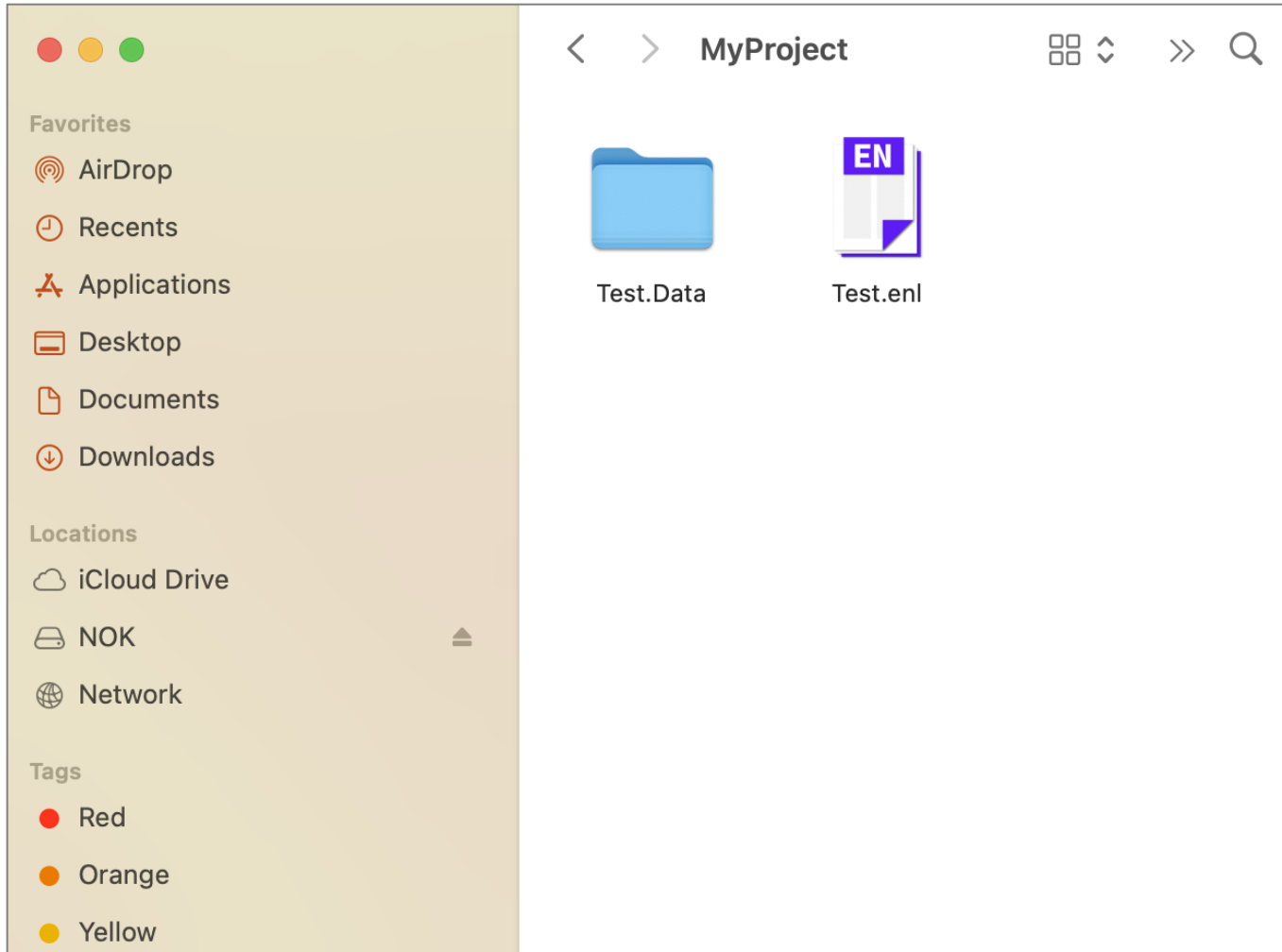
The screenshot displays the Mahidol Software License portal. The header includes the Mahidol University logo and name in Thai and English. The main content area is titled "Mahidol Software License" and features several software categories: Microsoft Windows, Microsoft Office, Application (highlighted with a pink box and circled number 3), Key License (highlighted with a pink box and circled number 4), VPN, and Antivirus. To the right, a detailed view of the "Application" category shows two options: "EndNote 21 for Windows" and "EndNote 21 for Mac", each with a "คู่มือ" (Manual) button and a "DOWNLOAD" button. Below that, the "Key License" category shows a "Key License EndNote 21" option with a "DOWNLOAD" button. Arrows indicate the flow from the highlighted categories to their respective download options.

Copyright © 2023 Mahidol University. All rights reserved. E-mail: consult@mahidol.ac.th Phone: 662-849-6022

Get Started with EndNote

- **EndNote Library components**
- **Creating a New Library**
- **Library Overview**
- **Journal Term Lists**

EndNote Library components

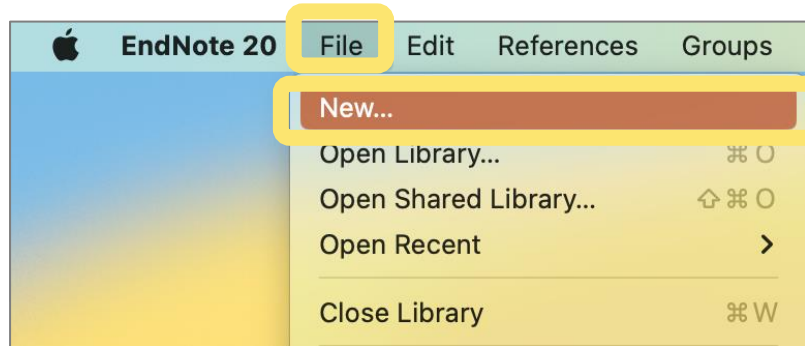


- EndNote libraries are made up of two parts:
 - EndNote Library file (*.enl)
 - Data folder (*.Data)These two parts must be kept together to work correctly.
- Keep EndNote libraries on your computer's local hard drive. Storing and editing libraries on a network drive can lead to corruption and performance issues.
- EndNote libraries should never be stored in cloud-syncing folders such as Google Drive, OneDrive, etc. Syncing folders corrupt EndNote libraries over time.

Creating a New Library

1. Go to **File > New...** or select **Creating a New Library** from Set up Endnote Library box
2. EndNote presents a dialog prompting you to enter a name for your new library.
3. Select the location where you will save the library.
4. Click **Save**, then the new Endnote library appears as an empty library.

1



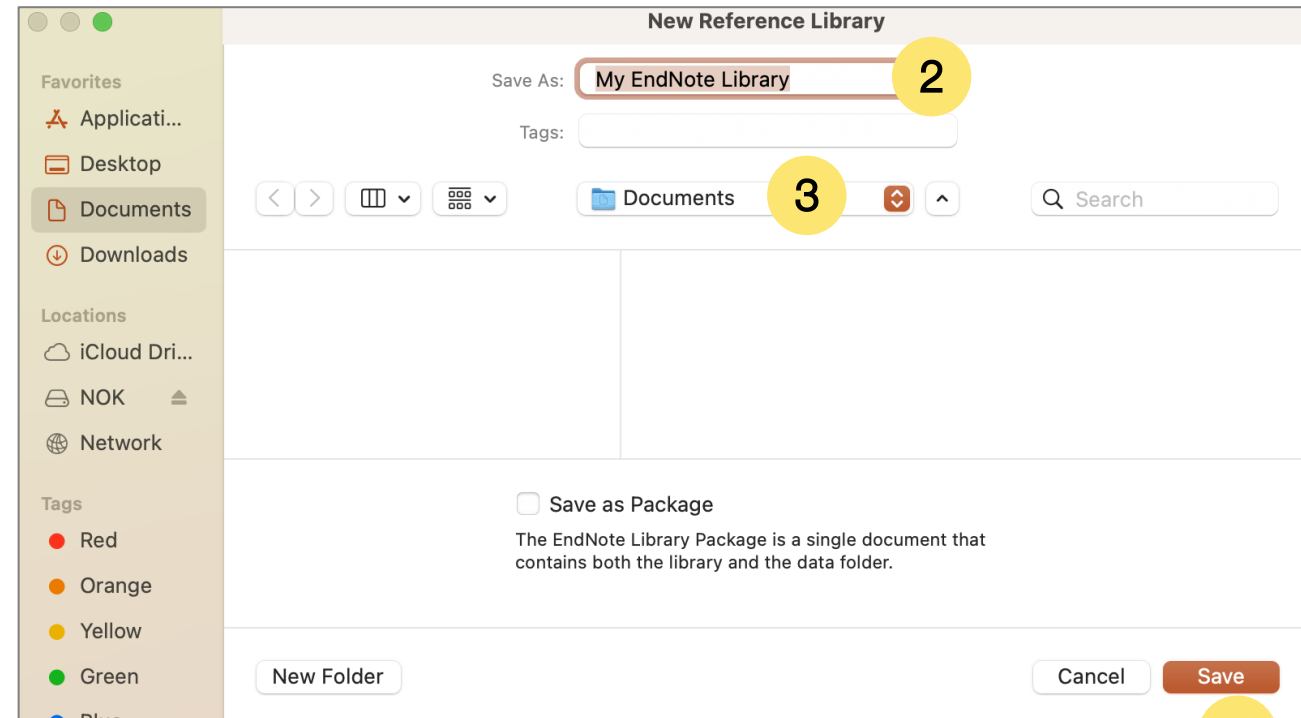
Set up EndNote Library

If you already have an EndNote library, please locate it and we'll get it set up.

[Open an existing library](#)

Alternatively, you can start from scratch with a new library.

[Create a new library](#)



4

Library Overview

The screenshot displays the EndNote 20 - Test.enl application window. The interface is divided into three main sections:

- Left Sidebar (Navigation):** Contains a 'Sync Configuration' button at the top. Below it are several menu items: 'All References' (highlighted in teal), 'Recently Added', 'Unfiled', 'Trash', 'MY GROUPS' (with a sub-item 'My Groups'), 'FIND FULL TEXT', 'GROUPS SHARED BY OTHERS', and 'ONLINE SEARCH' (with a '+' icon). Under 'ONLINE SEARCH', there are four search providers: 'Jisc Library Hub Discover', 'Library of Congress', 'PubMed (NLM)', and 'Web of Science Core Collectio...'. A search bar at the bottom of the sidebar is labeled 'Search for group'.
- Central Panel (References):** Titled 'All References' at the top. It features a search bar with a magnifying glass icon and a button labeled 'Advanced Search'. Below the search bar, the text 'All References' is displayed, followed by '0 References'. A row of icons includes a quote mark, a plus sign in a box, a person icon, a hand icon, a magnifying glass, and a globe. Below these icons is a table header with columns: a pencil icon, 'Author', 'Year', an upward arrow, and 'Title'. The table body is currently empty.
- Right Panel (Status):** A light gray panel with the text 'No reference selected' and a close button (X) in the top right corner.

Library Overview

Menu Bar

Search panel to find an item in your library or to query a remote database for new references to capture.

Groups panel shows you both default groups and groups or group sets that you create for your research projects.

The screenshot shows the EndNote 21 interface with several callouts. The top menu bar includes Apple logo, EndNote 21, File, Edit, References, Groups, Tags, Library, Tools, Window, and Help. The main window title is 'EndNote 21 - Sample_Library_21.enl'. On the left is the 'Groups panel' showing a tree view of 'All References' (190), 'Recently Added', 'Unfiled' (1), 'Trash' (2), and 'MY GROUPS' including 'Avian Intelligence' (with sub-groups 'Avian Cognition' 33, 'Corvids' 24, 'Corvids & Parrots' 6, 'Parrots' 28), 'Bats' (with sub-groups 'Chiroptera' 27, 'Echolocation' 10, 'Echolocation OR...' 13, 'Sonar' 8), and 'My Groups' 155. Below are 'MY TAGS' (Bats 27, Corvids 21, Parrots 63), 'FIND FULL TEXT', 'GROUPS SHARED BY O...', and 'ONLINE SEARCH' (Jisc Library Hub Disco..., Library of Congress, PubMed (NLM), Web of Science Core C...). A search bar at the bottom of the panel says 'Search for group'. The central 'Reference List panel' is a table with columns: Year, Title, Journal, Last Updated, Author. It lists references from 2011 to 1988. The 2012 entry is highlighted. The top of this panel has a search filter section with 'Author', 'Contains', 'Year', 'Title', and 'Simple Search' options. The right side features a 'Tab panel' for the selected reference 'Taylor, 2012 #2306', showing a 'Summary' tab with the title 'New Caledonian crows reason about hidden causal agents', authors 'A. H. Taylor, R. Miller and R. D. Gray', and publication details. Below it is a 'Preview panel' showing the reference formatted in APA 7th style.

Tab panel Summary tab displays a detailed overview of a selected reference. Quickly alter reference metadata from the Edit tab.


Preview panel shows you how a reference would appear formatted with a specific output style.

Reference List panel shows the individual references stored in your EndNote library, also known as library records.

Journal Term Lists

Journal Term Lists is lists of journal name in full and abbreviated form.

- These lists are used for making correct journal name in reference format.
- Help EndNote works correctly find out the duplicate references.

Recently Added				
2 References				
	Author	Year	Title	Journal
	Li, Zhuo; Hirst, Jonathan D.	2020	Computed optical spectra of SARS-CoV-2 proteins	Chemical Physics Letters
	Li, Z.; Hirst, J. D.	2020	Computed optical spectra of SARS-CoV-2 proteins	Chem Phys Lett


*ScienceDirect**
give full journal name

*PubMed**
give abbreviated journal name

**Retrieving reference from various sources may give the journal name in different form.*

Before & After defining Journal Term Lists

Before



ScienceDirect

Give full journal name

Vancouver

Insert Copy

1. Li Z, Hirst JD. Computed optical spectra of SARS-CoV-2 proteins. **Chemical Physics Letters.** 2020;758:137935.

After

Vancouver

Insert Copy

1. Li Z, Hirst JD. Computed optical spectra of SARS-CoV-2 proteins. **Chem Phys Lett.** 2020;758:137935.

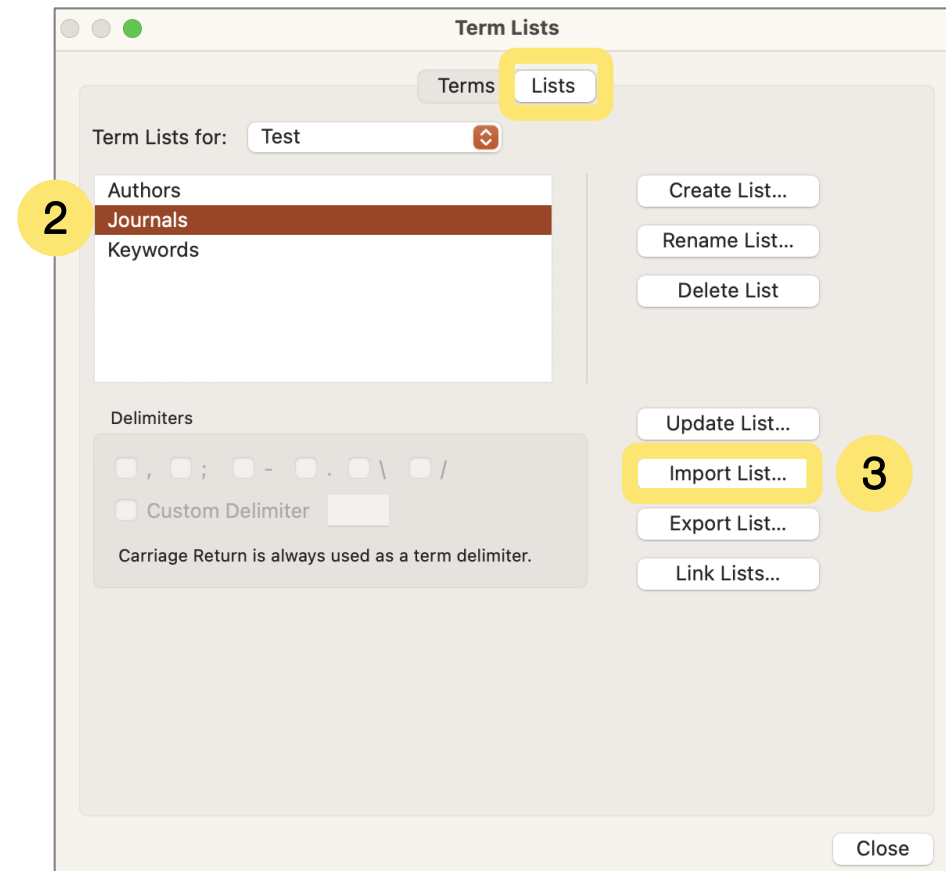
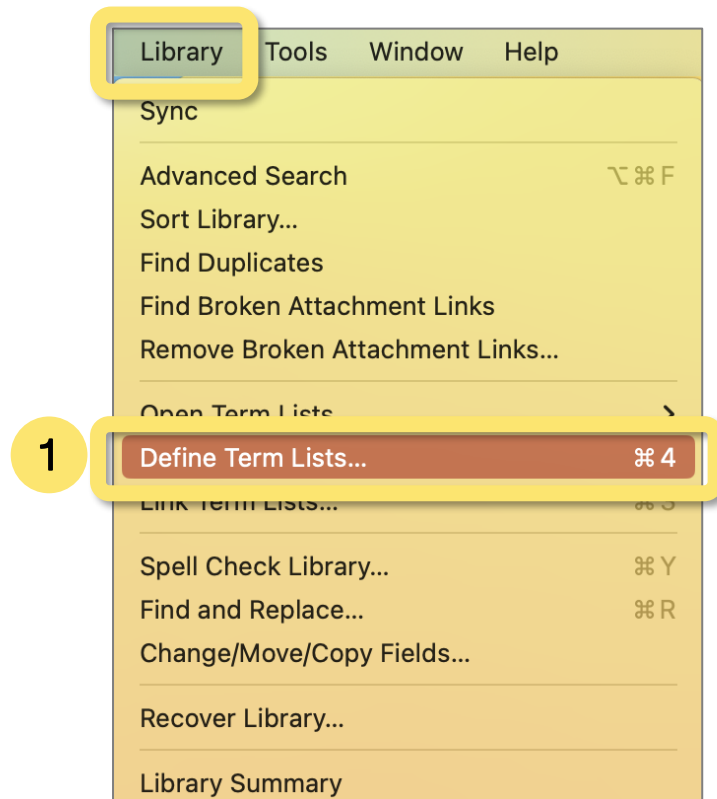
Vancouver Style use the abbreviated journal name

Define Journal Term Lists (1)

1. Go to **Library > Define Term Lists...**

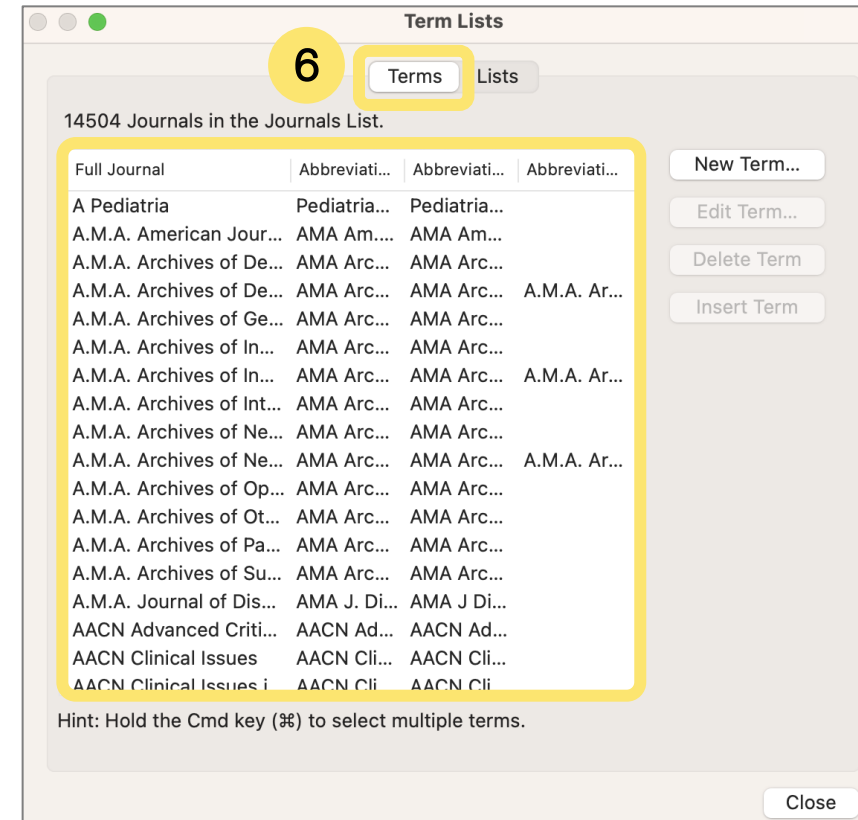
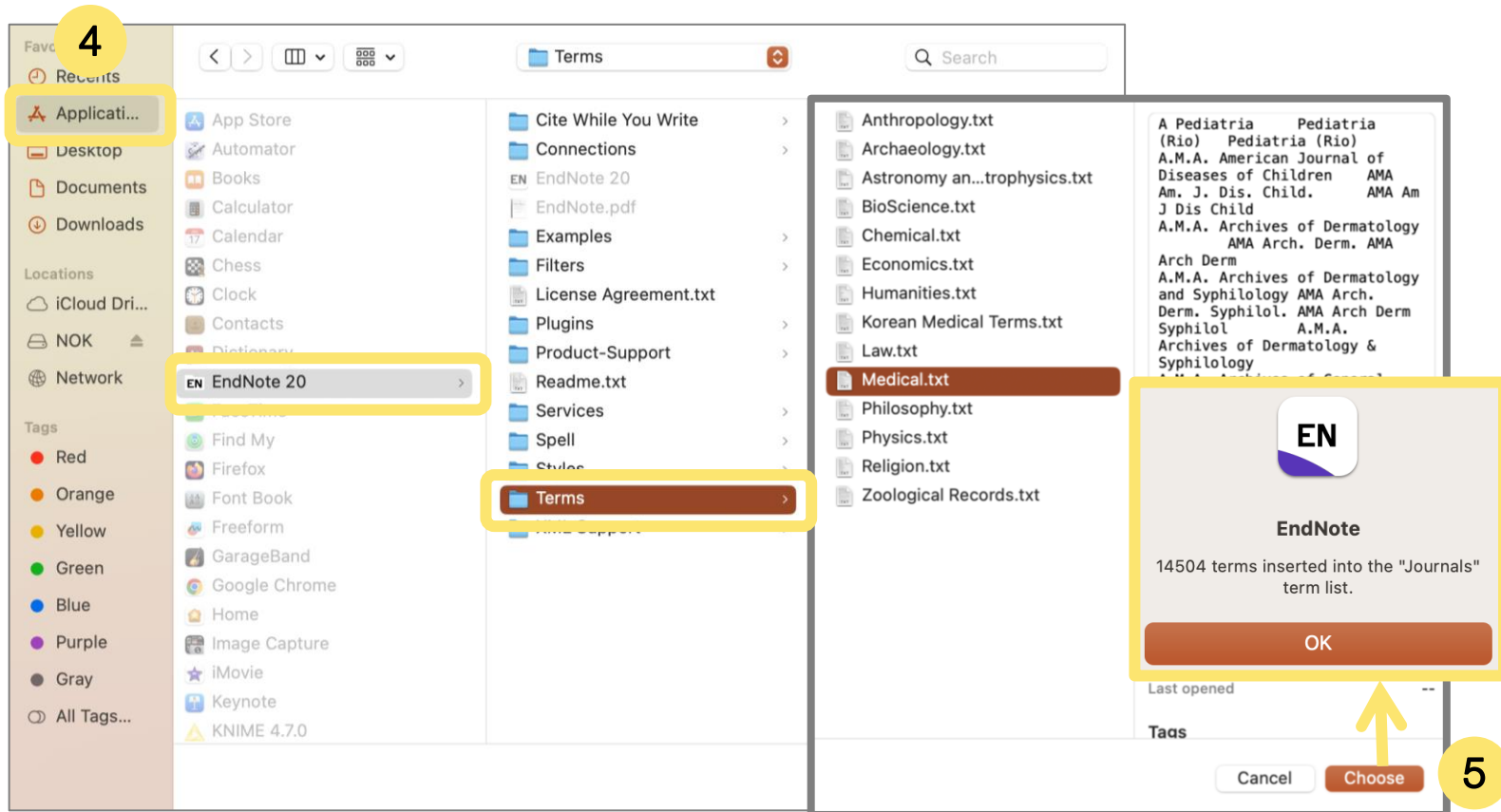
2. In Term Lists box, select tab **Lists**, then select **Journals**

3. Click at **Import List...**



Define Journal Term Lists (2)

4. Browse to **Application > EndNote 21 > Terms**
5. Choose the appropriated term lists files (e.g. Medical.txt), then click **Choose** to completed.
6. Select tab **Terms** to view the imported journal lists, then close.



Input Data

- **Direct Export**
- **Import PDF**
- **Manual Typing**

Direct Export

Import PDF

Manual Typing



ScienceDirect



Scopus®

Google Scholar



New Reference

Journal Article

Author

Year

Title

Journal

Volume

Part/Supplement

Issue

Pages

Start Page

Errata

Epub Date

Date

Type of Article


Short Title

Alternate Journal


ISSN

DOI

Mahidol eJournal Access (EZproxy)



Mahidol University
Library and Knowledge Center
Mahidol eJournal Access

I'm not a robot 
reCAPTCHA
Privacy - Terms

firstname.sur (for staff) or u61xxx or g61xxx

type your password

028002680-9 ext.4262,4265 [Manual](#)
liwww@mahidol.ac.th

- URL: <https://ejournal.mahidol.ac.th>
- Login with MU Internet account to access subscribed e-resource
- Support all devices all operating systems (Windows, MacIntosh and Linux), smart phone and tablet with iOS (iPhone / iPad) and Android

***** Limitation *****

Must follow the links given in library's website

Mahidol eJournal Access (EZproxy)

The screenshot shows the website <https://stang.sc.mahidol.ac.th/> with the following elements:

- 1**: The "E-Resources" menu is highlighted, and its dropdown is open, showing options like "E-DATABASES", "E-JOURNALS", and "E-BOOKS".
- 2**: A red banner at the top right contains the URL <https://ejournal.mahidol.ac.th>.
- 3**: The "eJournal Access" button, represented by a key icon, is highlighted in the footer.
- 4**: A grid of database logos is highlighted in the footer, including Scopus, ScienceDirect, SciVal, SJR, Journal Citation Reports, EBSCO, SCIFINDER, ACS Publications, PubMed.gov, nature, WILEY, Springer Link, AMERICAN SOCIETY FOR MICROBIOLOGY, BMC, zbMATH, Ovid, DOAJ, Google Scholar, turnitin, and EndNote.

You can access by

1. Select menu E-Resources to find appropriated E-Databases, E-Journals or E-Books
2. Click URL from the top of webpage
3. Click eJournal Access button
4. Select appropriated E-databases from bottom of webpage

Direct export: ScienceDirect



ScienceDirect

Journals & Books



Register

Sign in

Search for peer-reviewed journal articles and book chapters (including [open access content](#))

Keywords

Author name

Journal/book title

Volume

Issue

Pa



Advanced search



The most relevant research on Novel Coronavirus (SARS-CoV-2) and related viruses is [available for free on ScienceDirect](#), and can be downloaded in a machine-readable format for text mining.

Alternatively, visit the Elsevier Novel Coronavirus Information Center for general health information and advice.

[Visit the Information Center >](#)



1. Mark the records you need.
2. Click **Export** at the top of search results.
3. Select **Export citation to RIS** to input data to your library.

Find articles with these terms

Coronavirus

Advanced search

1

2

45,746 results

Set search alert

Refine by:

Subscribed journals

Years

2022 (10)

2021 (12,137)

2020 (19,913)

Show more

Download 25 articles

Export

Short communication

Prior and novel coronaviruses, **Coronavirus** Disease 2019: How well known?

Fertility and Sterility, 16 April 2020, ...

James Segars, Quinton Katler, ... Jennifer F. Kawwass

Abstract Extracts Export

Research article Full text access

In-hospital cardiac arrest in patients with **coronavirus** 2019

Resuscitation, 27 January 2021, ...

Oscar J. L. Mitchell, Eugene Yuriditsky, ... Benjamin S. Abella

Download PDF Abstract Extracts Export

Export

25 citations selected

Save to RefWorks

Export citation to RIS

Export citation to BibTeX

Export citation to text

3

Direct export: PubMed



National Library of Medicine
National Center for Biotechnology Information

Log in

PubMed.gov

Search PubMed

Search

Advanced

PubMed® comprises more than 32 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full text content from PubMed Central and publisher web sites.

coronavirus

Advanced Create alert Create RSS

Save

Email

Send to

1. Mark the records you need.
2. Click **Send to** at the top of search results, then select **Citation manager**.
3. Select the options.
4. Click **Create file** button to input data to your library.

MY NCBI FILTERS

RESULTS BY YEAR



TEXT AVAILABILITY

- Abstract
- Free full text
- Full text

97 records

1

1

Cite

Share

Clipboard

My Bibliography

Collections

Citation manager

2003, there were only 10 **coronaviruses** with complete genomes. From the start of the year up to December 2008, there was an addition of 16 **coronaviruses** ...

Broad-spectrum coronavirus antiviral drug discovery.

Totura AL, Bavari S.

Cite

Expert Opin Drug Discov. 2019 Apr;14(4):397-412. doi: 10.1080/1746044

8.

Share

PMID: 30849247 **Free PMC article.** Review.

The highly pathogenic **coronaviruses** severe acute respiratory syndrome **coronavirus** (SARS-CoV) and

Create a file for external citation management software

Selection: Selection (2)

Create file

Cancel

Selection (2)

All results on this page

All results

Selection (2)

Direct export: Scopus



Scopus

[Search](#) [Sources](#) [Lists](#) [SciVal](#) ↗



[Create account](#)

[Sign in](#)

Start exploring

Discover the most reliable, relevant, up-to-date research. All in one place.

[Documents](#) [Authors](#) [Affiliations](#)

[Search tips](#) ⓘ

Search within

Article title, Abstract, Keywords



Search documents *

[+ Add search field](#) [Add date range](#) [Advanced document search](#) >

[Search](#) 🔍

[Search History](#)

[Saved Searches](#)



Start searching and your history will appear here. If you need help to start searching check out our [search tips](#).



196,547 document results

TITLE-ABS-KEY (coronavirus) AND (LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020))

Edit Save Set alert

Search within results...

Refine results

Limit to Exclude

Open Access

- All Open Access (162,607) >
- Gold (62,710) >
- Hybrid Gold (13,105) >
- Bronze (74,979) >
- Green (127,362) >

Learn more

Year

- 2022 (17,226) >

Documents Secondary documents

Analyze search results

Export Download View citation

Document title

1 Patient-related outcomes in patients re-visited a COVID-19 clinic with persisting symptoms following COVID-19
Open Access

View abstract View at Publisher Related documents

2 Negative pressure protective barrier device used in dental emergencies during the COVID-19 pandemic | [Dispositivo de barrera protectora con presión negativa utilizado en urgencias odontológicas durante la pandemia de COVID-19] Mendivelso, F., Guevara, C., Bernal, L., López, L., Low, E. 2022 *Iatreia* 35(1), pp. 29-39 0

1. Select the records you need.
2. Click **Export** at the top of search results, then it will present a **Export document setting** Box

Export document settings

You have chosen to export 196547 documents

Select your method of export

MENDELEY
 ExLibris ReWorks
 SciVal
 RIS Format EndNote, Reference Manager
 CSV Excel
 BibTeX
 Plain Text ASCII in HTML

What information do you want to export?

<input checked="" type="checkbox"/> Citation information	<input checked="" type="checkbox"/> Bibliographical information	<input type="checkbox"/> Abstract & keywords	<input type="checkbox"/> Funding details	<input type="checkbox"/> Other information
<input checked="" type="checkbox"/> Author(s) <input checked="" type="checkbox"/> Author(s) ID <input checked="" type="checkbox"/> Document title <input checked="" type="checkbox"/> Year <input checked="" type="checkbox"/> EID <input checked="" type="checkbox"/> Source title <input checked="" type="checkbox"/> volume, issue, pages <input checked="" type="checkbox"/> Citation count <input checked="" type="checkbox"/> Source & document type <input checked="" type="checkbox"/> Publication Stage <input checked="" type="checkbox"/> DOI <input checked="" type="checkbox"/> Open Access	<input checked="" type="checkbox"/> Affiliations <input checked="" type="checkbox"/> Serial identifiers (e.g. ISSN) <input checked="" type="checkbox"/> PubMed ID <input checked="" type="checkbox"/> Publisher <input checked="" type="checkbox"/> Editor(s) <input checked="" type="checkbox"/> Language of original document <input checked="" type="checkbox"/> Correspondence address <input checked="" type="checkbox"/> Abbreviated source title	<input type="checkbox"/> Abstract <input type="checkbox"/> Author keywords <input type="checkbox"/> Index keywords	<input type="checkbox"/> Number <input type="checkbox"/> Acronym <input type="checkbox"/> Sponsor <input type="checkbox"/> Funding text	<input type="checkbox"/> Tradenames & manufacturers <input type="checkbox"/> Accession numbers & chemicals <input type="checkbox"/> Conference information <input checked="" type="checkbox"/> Include references

Cancel **Export**



Export document settings [?](#)

You have chosen to export 196547 documents

Select your method of export

- MENDELEY
- ExLibris RefWorks
- SciVal [i](#)
- RIS Format**
EndNote, Reference Manager
- CSV
Excel
- BibTeX
- ASCII in HTML

3

4

3. Select the record's information you need.
(recommended at least *citation information*)
4. Select method of export as **RIS Format**
5. Click **Export** button to input data to your library.

What information do you want to export?


- | | | | | |
|--|--|--|--|--|
| <input checked="" type="checkbox"/> Citation information | <input checked="" type="checkbox"/> Bibliographical information | <input type="checkbox"/> Abstract & keywords | <input type="checkbox"/> Funding details | <input type="checkbox"/> Other information |
| <input checked="" type="checkbox"/> Author(s) | <input checked="" type="checkbox"/> Affiliations | <input type="checkbox"/> Abstract | <input type="checkbox"/> Number | <input type="checkbox"/> Tradenames & manufacturers |
| <input checked="" type="checkbox"/> Author(s) ID | <input checked="" type="checkbox"/> Serial identifiers (e.g. ISSN) | <input type="checkbox"/> Author keywords | <input type="checkbox"/> Acronym | <input type="checkbox"/> Accession numbers & chemicals |
| <input checked="" type="checkbox"/> Document title | <input checked="" type="checkbox"/> PubMed ID | <input type="checkbox"/> Index keywords | <input type="checkbox"/> Sponsor | <input type="checkbox"/> Conference information |
| <input checked="" type="checkbox"/> Year | <input checked="" type="checkbox"/> Publisher | | <input type="checkbox"/> Funding text | <input type="checkbox"/> Include references |
| <input checked="" type="checkbox"/> EID | <input checked="" type="checkbox"/> Editor(s) | | | |
| <input checked="" type="checkbox"/> Source title | <input checked="" type="checkbox"/> Language of original document | | | |
| <input checked="" type="checkbox"/> volume, issue, pages | <input checked="" type="checkbox"/> Correspondence address | | | |
| <input checked="" type="checkbox"/> Citation count | <input checked="" type="checkbox"/> Abbreviated source title | | | |
| <input checked="" type="checkbox"/> Source & document type | | | | |
| <input checked="" type="checkbox"/> Publication Stage | | | | |
| <input checked="" type="checkbox"/> DOI | | | | |
| <input checked="" type="checkbox"/> Open Access | | | | |


5

Cancel **Export**

Direct export: Google Scholar



 My profile

 My library

SIGN IN

Google Scholar



Articles Case law

New! Track and manage your public access mandates

Articles about COVID-19

CDC

NEJM

JAMA

Lancet

Cell

BMJ

Nature

Science

Elsevier

Oxford

Wiley

medRxiv

Stand on the shoulders of giants

1. Click **Cite** sign at the bottom of a record you need.
2. Click **EndNote** button to input data to your library.

Articles

About 1,450,000 results (0.03 sec)

Any time

Since 2021

Since 2020

Since 2017

Custom range...

Sort by relevance

Sort by date

include patents

include citations

Create alert

Coronavirus

World Health Organization - 2020 - pesquisa.bvsalud.org

Coronaviruses (CoV) are a large family of viruses that cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). A novel coronavirus (nCoV) is

☆ Cited by 5108

[HTML] Another decade

S Perلمان - 2020 - Mass M

For the third time in as many years, a new coronavirus has emerged in human populations. This virus, which was first identified in Wuhan, China, in persons with

☆ Cited by 742

Coronavirus disease

F He, Y Deng, W Li - Journ

In late December 2019, a coronavirus was first identified in Wuhan, China. A few days later, it was identified as a novel coronavirus

☆ Cited by 556

Cite

MLA	Perlman, Stanley. "Another decade, another coronavirus." (2020): 760-762.
APA	Perlman, S. (2020). Another decade, another coronavirus.
Chicago	Perlman, Stanley. "Another decade, another coronavirus." (2020): 760-762.
Harvard	Perlman, S., 2020. Another decade, another coronavirus.
Vancouver	Perlman S. Another decade, another coronavirus.

[BibTeX](#)
EndNote
RefMan
RefWorks

1

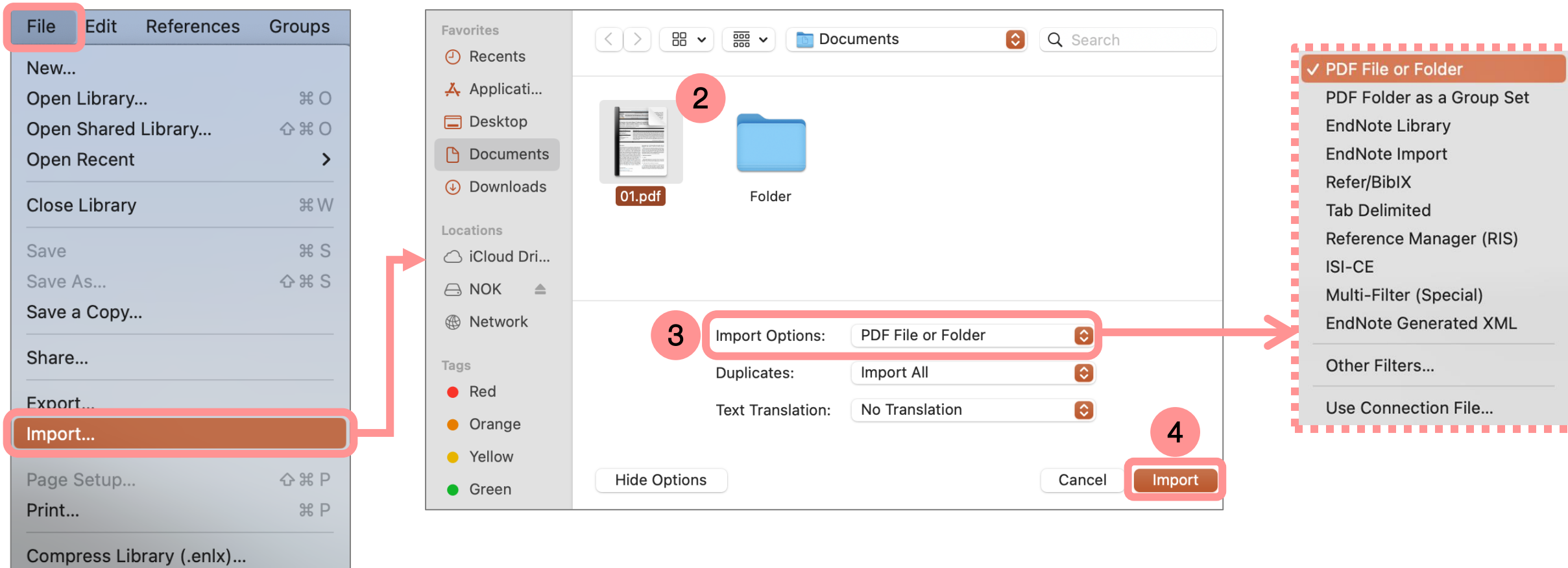
2

[HTML] nejm.org

[PDF] wiley.com

Import PDF File or Folder (1)

1. Go to **File > Import...** EndNote presents a dialog to find the location where you keep a PDF file.
2. Select a PDF file or folder from your hard drive.
3. Set Import Option as **PDF File or Folder**
4. Click **Import** to import a PDF file or folder into your library.



Import PDF File or Folder (2)

The screenshot displays the EndNote 20 interface. On the left, a sidebar contains navigation options: Sync Configuration, All References (10), Imported References (1), Recently Added (1), Unfiled (10), Trash, MY GROUPS, My Groups, FIND FULL TEXT, GROUPS SHARED BY..., and ONLINE SEARCH (+). Below these are search options for Jisc Library Hub Di..., Library of Congress, PubMed (NLM), and Web of Science Co... The main window is titled 'EndNote 20 - Library_6500001.enl' and shows 'Imported References'. A search bar and 'Advanced Search' button are at the top. Below, a table lists '1 References' with columns for Author, Year, and Title. The entry for 'Kamboj, K.; Jana, S... 2019 Mechanisms of protein kinas' is highlighted. To the right, a PDF preview of '01.pdf' is shown, displaying the title 'Mechanisms of protein kinase C-induced sustained activation of extracellular signal-regulated kinase in the hippocampus' by Kautuk Kamboj, Subhajit Jana, and Shiv K. Sharma. The PDF content includes an abstract, introduction, and materials and methods sections.

EndNote 20 - Library_6500001.enl

Imported References

Search Advanced Search

Imported References

1 References

Author	Year	Title
Kamboj, K.; Jana, S...	2019	Mechanisms of protein kinas

Kamboj, 2019 #10

Summary Edit PDF

01.pdf

453

454

455

456

457

458

Biochemical and Biophysical Research Communications 520 (2019) 453–458

Contents lists available at ScienceDirect

Biochemical and Biophysical Research Communications

Journal homepage: www.elsevier.com/locate/ybrc

Mechanisms of protein kinase C-induced sustained activation of extracellular signal-regulated kinase in the hippocampus

Kautuk Kamboj, Subhajit Jana, Shiv K. Sharma

National Brain Research Center, Manesar, 122052, Haryana, India

ARTICLE INFO

ABSTRACT

1. Introduction

2. Materials and methods

2.1. Animals

2.2. Hippocampal slice preparation and treatments

hippocampal slices [1]. Blocking ERK activity inhibits LTP [14]. Furthermore, ERK activity is required for memory formation [15,16].

Previous studies have shown that activation of protein kinase C by phorbol 12,13-dibutyrate (PDBu) activates ERK in the hippocampal slices [17,18]. However, the activation profile of PDBu-induced ERK activation is not well understood. In this study, we show that activation of PKC by PDBu leads to a sustained ERK activation in the hippocampus. Further, we have examined the processes that are important for PDBu-induced sustained ERK activation.

Male Sprague Dawley rats (6–8 weeks old) were used in the experiments. The animals were allowed free access to rodent chow and water. They were housed under a light/dark cycle of 12 h/12 h.

The methods used in this study have been described previously [19–21]. Briefly, the animals were killed in accordance with the procedure approved by the Animal Ethics Committee of National Brain Research Center. After anesthetizing with halothane (Pranal Healthcare), the animals were killed and their hippocampi were removed. After preparing hippocampal slices (350 μ m), pooling and recovery, the slices were randomly divided into experimental groups, with 3–4 slices in each group. To examine PDBu-induced ERK activation, the slices were treated with 3 μ M PDBu [19] for 25 min in artificial cerebrospinal fluid (aCSF). The composition of aCSF was: 25 mM glucose, 1.25 mM NaH₂PO₄, 25 mM NaHCO₃, 125 mM NaCl, 2.5 mM KCl, 1 mM MgCl₂, 2 mM CaCl₂. A stock solution of PDBu (Stem Cell Sciences) was prepared at 3 mM in dimethyl sulfoxide (DMSO). ERK activation was assessed immediately after PDBu treatment (immediate) or 1 h after PDBu treatment (sustained). For analysis of immediate ERK activation, the slices were washed using aCSF before harvesting in sodium dodecyl sulfate containing lysis buffer (SDS-LB) within 1–2 min after treatment. For analysis of sustained ERK activation, the slices were washed with aCSF after PDBu treatment, incubated in aCSF for 1 h, and harvested in SDS-LB.

The effect of pharmacological agents on ERK activation was examined at immediate and sustained time points. A stock solution of protein synthesis inhibitor (cycloheximide, Cyclo), transcriptional inhibitor (actinomycin D, ActD), mammalian target of rapamycin

Similarly, ERK₁ and ERK₂ bands were quantified together. ERK activation was estimated by dividing phospho-ERK_{1/2} signal by ERK_{1/2} signal in each sample, then normalizing with the control sample. Likewise, for each sample, ERK_{1/2}/tubulin signal ratio was obtained and normalized by the control sample. ERK activation or ERK levels at the immediate and sustained time points were assessed simultaneously in slices from the same animal. The samples were separated on the same gel. However, for clarity reasons, they are presented separately.

2.4. Data analysis

In Fig. 1, data were analyzed using paired Student's t-test (two-tailed). In Fig. 2, data were analyzed using one-way analysis of variance (ANOVA), which showed significant difference ($p < 0.05$). Thus, individual comparisons were assessed using paired Student's t-test (two-tailed). The differences between groups were considered significant when the p -value was less than 0.05. Data are expressed as mean \pm SEM.

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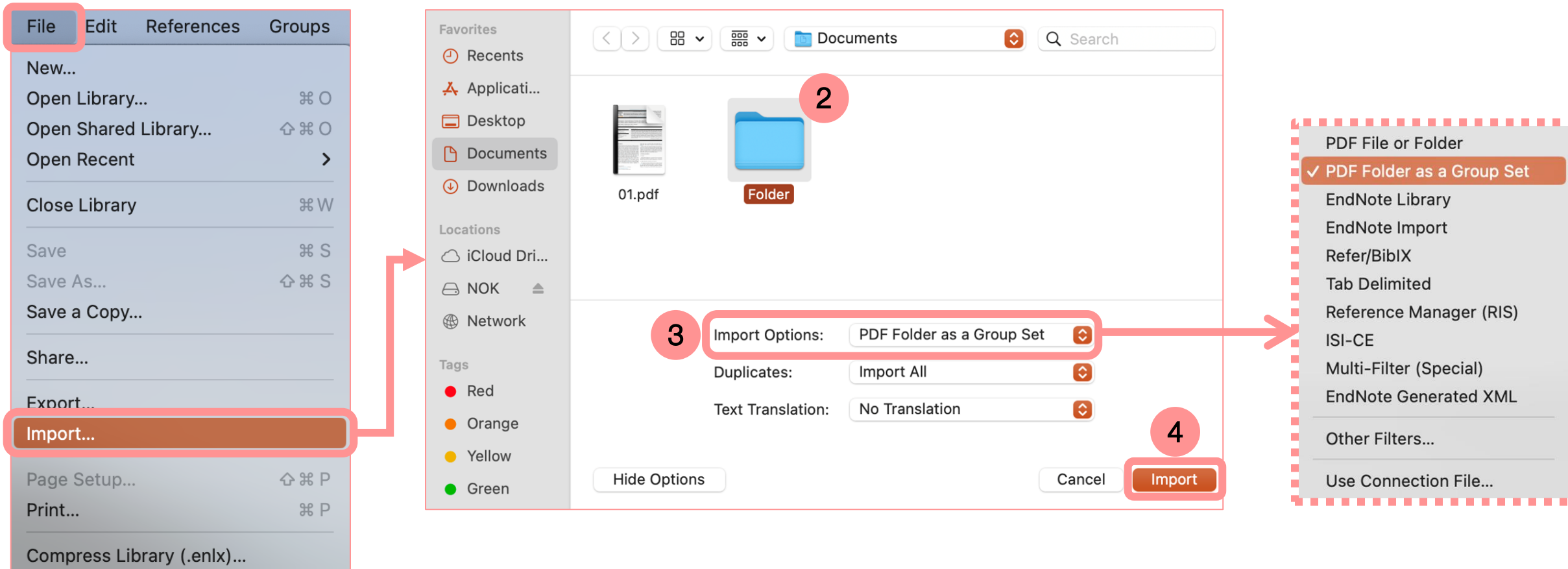
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The effect of pharmacological agents on ERK activation was examined at immediate and sustained time points. A stock solution of protein synthesis inhibitor (cycloheximide, Cyclo), transcriptional inhibitor (actinomycin D, ActD), mammalian target of rapamycin

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Bis-BODIPY linked-triazole based on catechol core for selective dual detection of Ag⁺ and Hg²⁺

Warorakri Saiyasombat^a and Supavadee Klattavej^{b*}

Herein, we introduced a new chemosensor, bis-BODIPY linked-triazole based on catechol (BODIPY-OO) prepared by bringing two units of BODIPY fluorophore/triazole binding group with a catechol unit. A solution of this compound displayed 4- and 2-fold enhancements in fluorescence intensity after adding a mole equivalent amount of Ag⁺ and Hg²⁺ ions in methanol media, respectively. ¹H NMR titrations of BODIPY-OO with Ag⁺ and Hg²⁺ suggested that the reaction was involved in the recognition process. BODIPY-OO showed high sensitivity toward Ag⁺ and Hg²⁺ over other metal ions with detection limits of 0.45 µM and 1 µM, respectively. It can also distinguish Hg²⁺ from Ag⁺ by addition of an EDTA. This compound can therefore be employed as practical fluorescent probe for monitoring the presence of Ag⁺ and Hg²⁺ ions.

Received 14th November 2020
Accepted 10th January 2021
DOI: 10.1039/D0Q9666e

Introduction

Since toxicity of heavy and transition metal ions affects biological and environmental systems, it is highly desirable to develop sensing probes to monitor and quantify these ions.^{1,2} Specifically, mercury is used in various industries such as pharmaceuticals, batteries, semi-conductors, agriculture, and paper industry.³ It is also widely used in dentistry and scientific research as amalgam.⁴ The Agency for Toxic Substances and Disease Registry (ATSDR) has ranked mercury as the third of most toxic substances.⁵ Its widespread use leads to the release and accumulation of mercury in general environment.⁶ Humans are exposed to mercury mainly through consumption of contaminated food, inhalation, and even through the skin causing gut lining and kidney damage, pneumonitis and disorder of many parts of the brain and peripheral nervous system.⁷ In addition to toxicity, silver has been extensively used by many industrial applications such as in photovoltaics, photography, jewelry and silversmith production.⁸ Silver has also long been known for its antimicrobial properties and has been used for years in the medical field.⁹ Although it shows a low level of toxicity to humans,¹⁰ high levels of the silver ion can inhibit glutathione (GSH), markers, and antioxidant enzymes.¹¹ Silver also reduces superoxide dismutase (SOD) levels causing an oxidative stress and production of reactive oxygen species (ROS). In addition, prolonged exposure to silver may lead to irreversible discoloration of skin or eyes, i.e. argyria or argyrosis.¹²

There are a lot of analytical techniques for mercury and silver determination such as atomic absorption spectrometry (AAS),¹³ inductively coupled plasma mass spectrometry (ICP-MS),¹⁴ inductively coupled plasma-atomic emission spectrometry (ICP-AES),¹⁵ and electrochemical methods.¹⁶ However, these methods are time-consuming and require sophisticated instrumentation. A simple, inexpensive, and efficient alternative is fluorescence sensor where binding of the analyte leads to a change in fluorescence which requires only cheap routine spectrometers.^{17–19} A good fluorescence sensor should not only be sensitive and selective but also allows real-time monitoring of targeted metal ions with low response time.²⁰

Small-molecule fluorescent chemosensors are usually composed of a fluorophore and a chelating or recognition unit. The fluorophores with excellent optical properties, such as coumarin,²¹ rhodamine,²² and BODIPY²³ provide highly sensitive fluorescent chemosensors. Among these, BODIPY derivatives show great potentials owing to their outstanding photophysical properties, i.e. spectral bands tunable along the whole visible spectrum, high molar absorption coefficients (48–600 cm² mol⁻¹), and high fluorescence quantum yields.²⁴ Owing to their soft character, nitrogen heterocyclic systems, e.g. pyridine,²⁵ quindoline,²⁶ imidazole,²⁷ and triazole²⁸ are mainly used as recognition units for various metal ions and tend to react with soft acids such as mercury and silver ions. The triazole ring has emerged as an exciting moiety in the study of sensors. This stems from a robust and green protocol for the synthesis of triazole derivatives.²⁹ In addition to metal sensors, triazole is extensively used in the synthesis of catalytic,³⁰ dendritic,³¹ boronoxide conjugates,³² and metal organic frameworks.³³

BODIPY-triazole combinations were reported as fluorescent chemosensors for the detection of metal ions, e.g. Hg²⁺,³⁴ Cu²⁺,³⁵ Al³⁺,³⁶ and Ag⁺.³⁷ This construction pattern offers following advantages: (i) click reaction affords triazoles in high yields with simple synthetic protocols; (ii) two triazole units acting as a chelating pocket can efficiently capture metal ions; (iii) the presence of two BODIPY fluorophore units improves the sensitivity of detection; and (iv) optical properties of the triazole containing BODIPY are easily tuned by modifications to spacers and chelating moieties.^{38–40} However, there are no reports on using such a fluorescent chemosensor template for recognizing multiple target ions which has the advantages of being cost-effective and highly efficient. In addition, the fluorescent chemosensors that can serve as bifunctional detection of mercury and silver ion are still rare.^{41–43} Herein, we designed and synthesized a new fluorescent sensor (BODIPY-OO) composed of two units of azido-BODIPY (2) and one unit of 1,2-bis(prop-2-ynyl)benzene (1) covalently linked by an alkyne-azide click chemistry approach (Scheme 1). Its spectroscopic properties were investigated. BODIPY-OO presented ‘turn-on’ fluorescence behaviors toward the silver and mercury ions over other interfering metal ions.

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* Electronic supplementary information (ESI) available: See DOI: 10.1039/D0Q9666e

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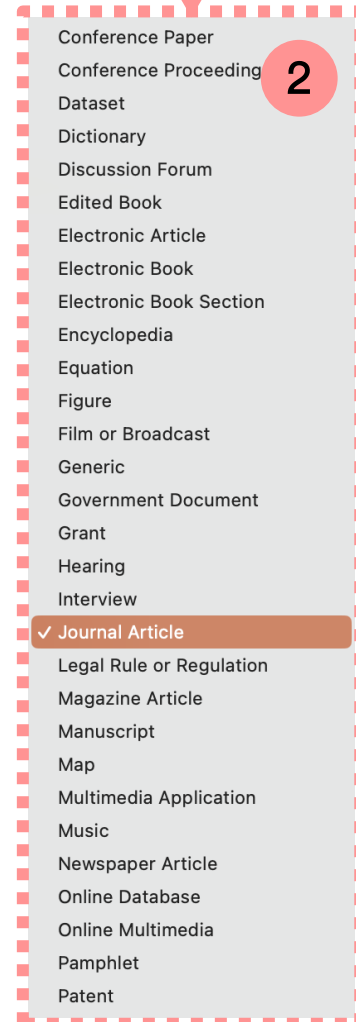
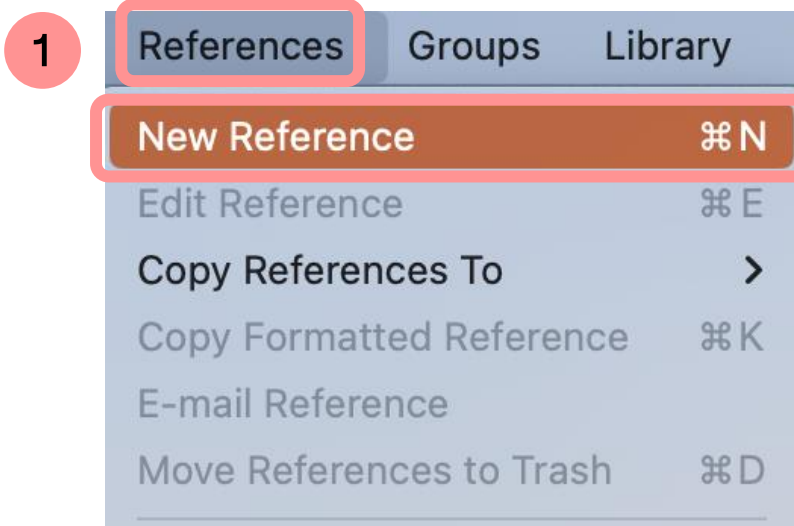
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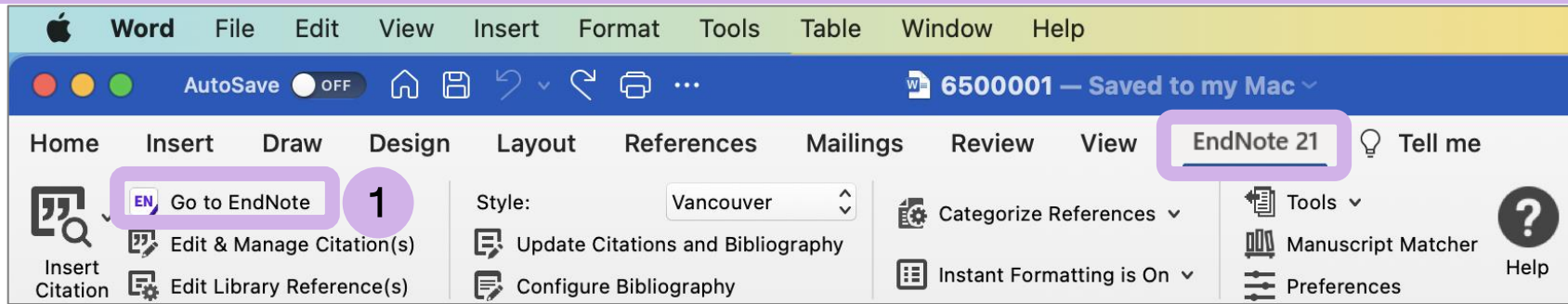
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Author Corcoran, A. J.
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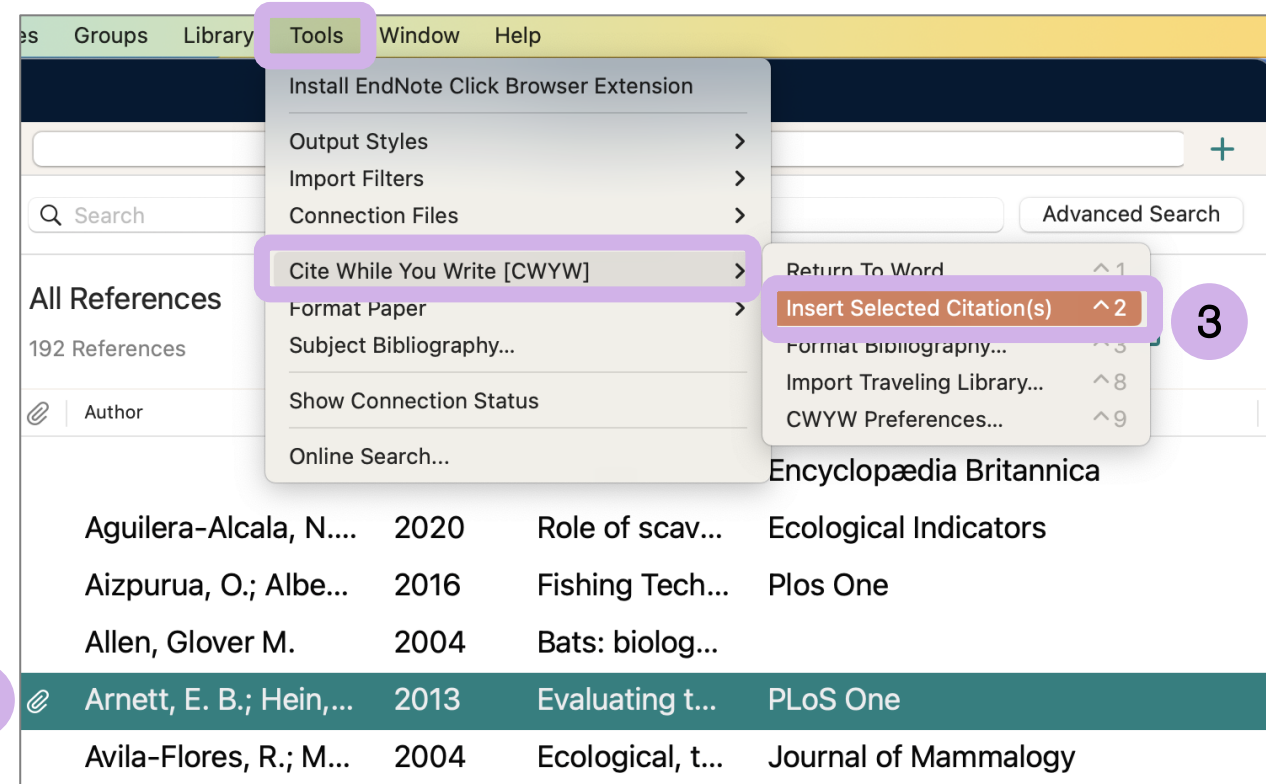
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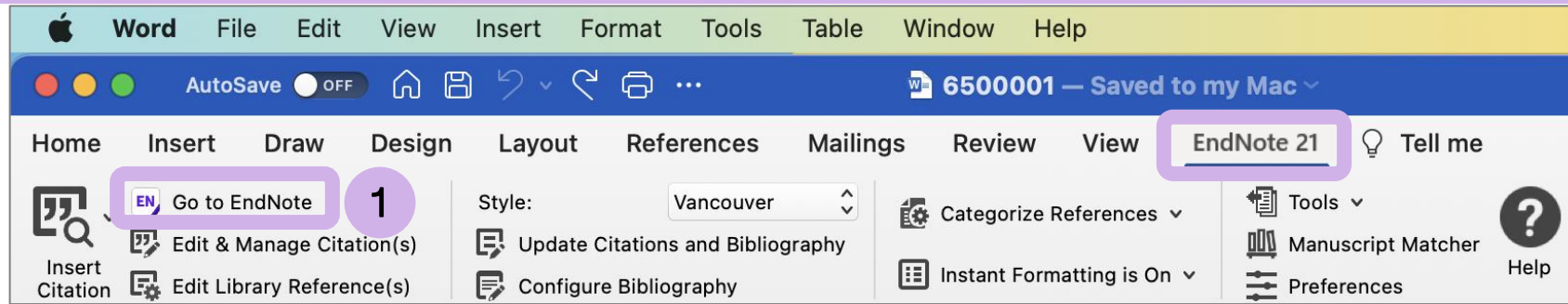
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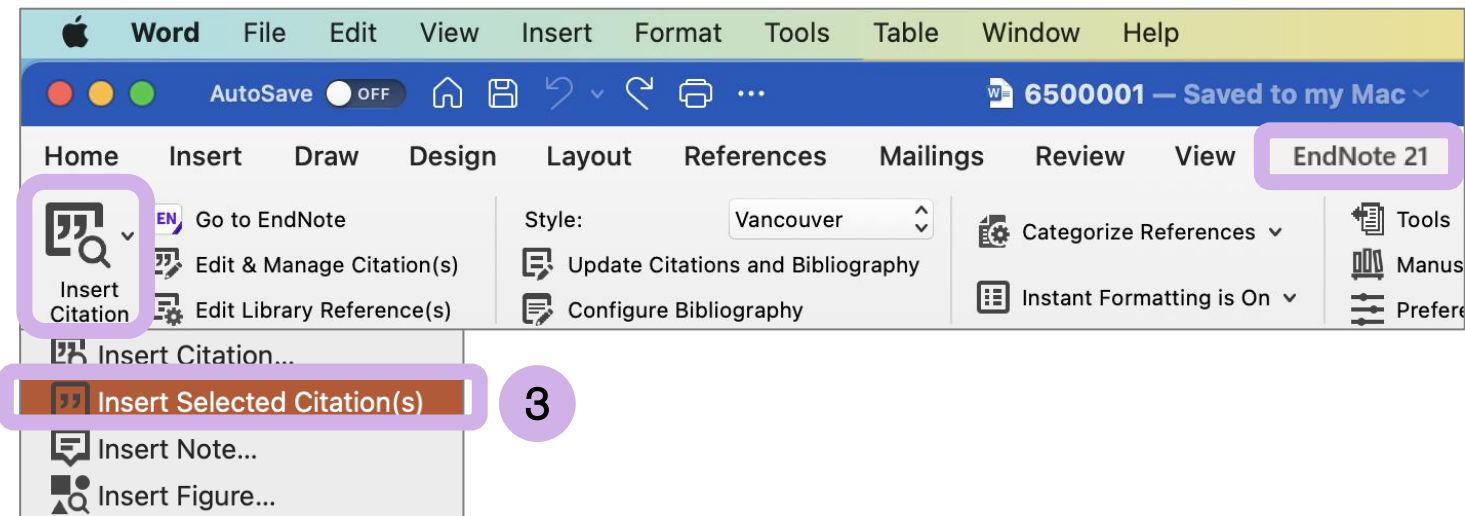
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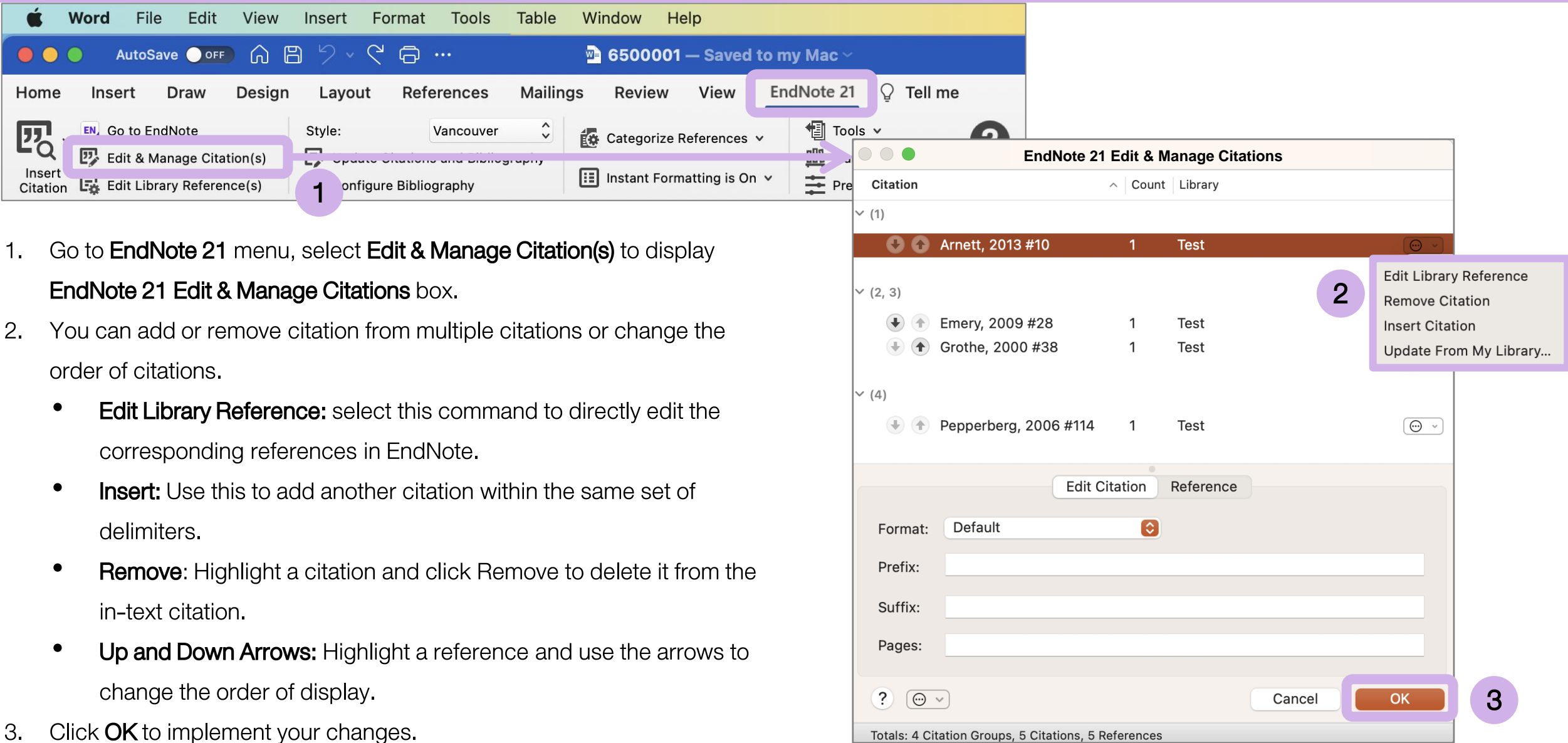
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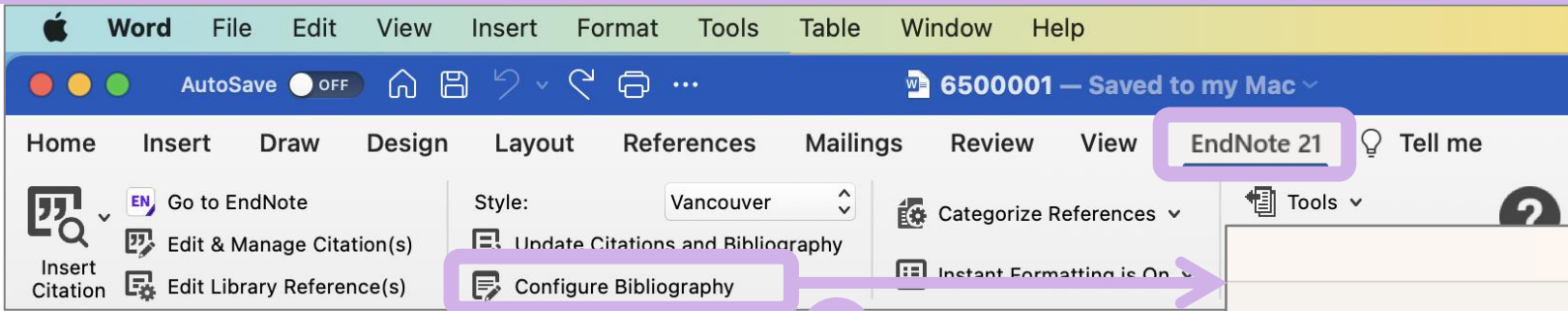
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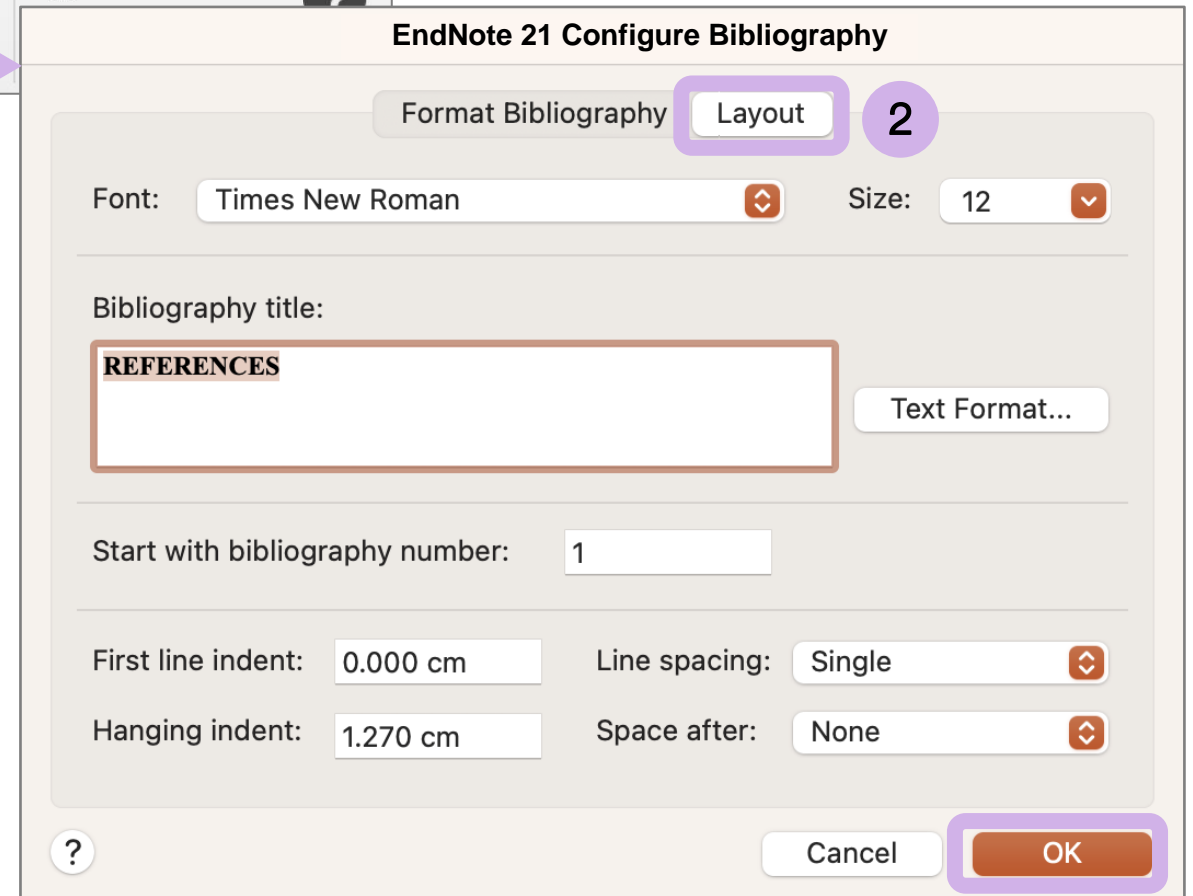
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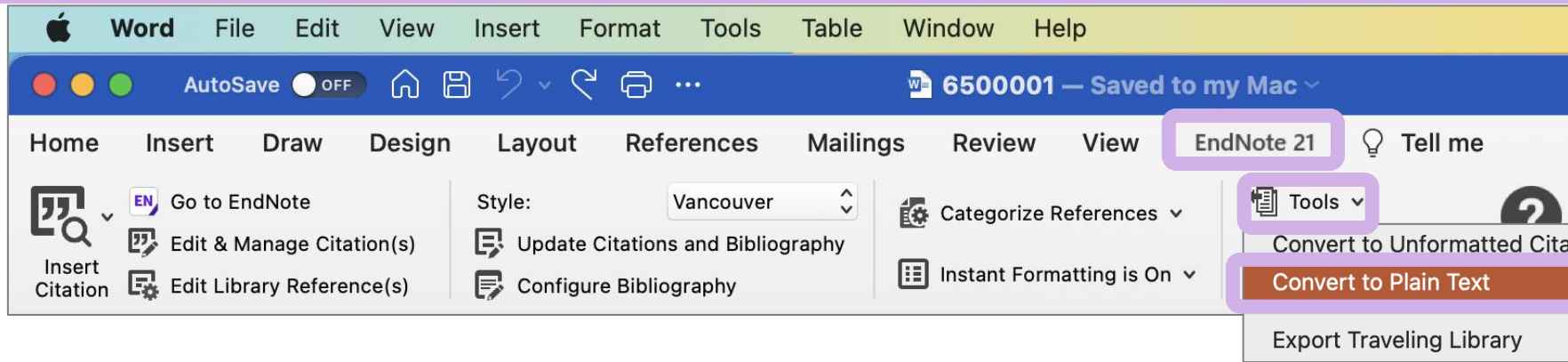
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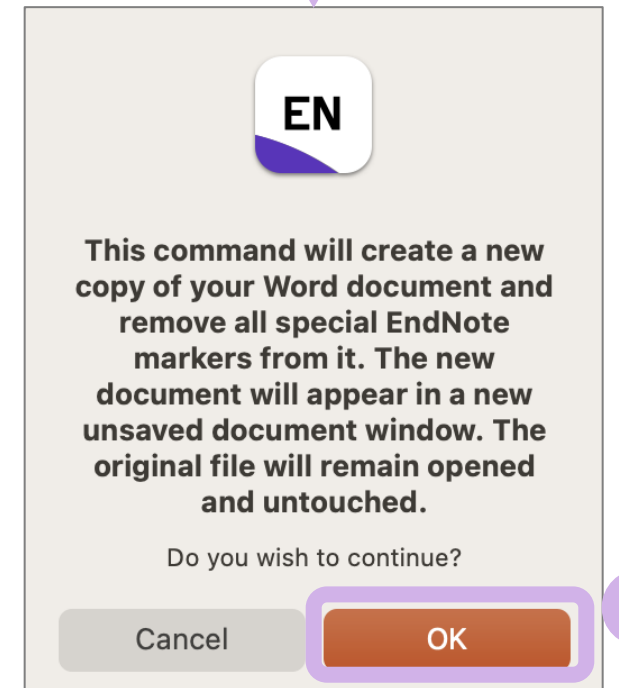


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