Tabriz University of
Medical Sciences

مدیریت منابع
(نرم‌افزار اندنوت)

دکتر زهرا کریم زاده

استادیار شیمی داروئی
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مدیریت منابع علمی و استناددهی در پژوهش

- در پژوهش‌های علمی، نگارش مقاله، پایان‌نامه و پروپوزال بدون استفاده از منابع معتبر امکان‌پذیر نیست.
- هر پژوهش علمی بر پایه‌ی مطالعات و یافته‌های پیشین شکل می‌گیرد و اعتبار آن به شیوه‌ی صحیح **ارجاع‌دهی و استناد به منابع** وابسته است.
- با افزایش حجم تولیدات علمی و رشد پایگاه‌های اطلاعاتی، مدیریت منابع پژوهشی به‌صورت دستی دشوار، زمان‌بر و همراه با خطا خواهد بود.
- به همین دلیل استفاده از **نرم‌افزارهای مدیریت منابع** به یک ضرورت برای پژوهشگران تبدیل شده است.

اهمیت استناد علمی

هر پژوهش علمی ادامه‌ی مسیر پژوهشگران پیشین است.

ارجاع‌دهی صحیح باعث می‌شود:

- اصالت علمی حفظ شود
- از **سرقت علمی** جلوگیری شود: *نرم‌افزارهای مشابهت‌یاب*
- اعتبار پژوهش افزایش یابد
- امکان پیگیری منابع برای خواننده فراهم شود

❑ هر جمله یا ایده‌ای که متعلق به شما نیست، باید رفرنس داشته باشد.

چرا به نرم‌افزار مدیریت منابع نیاز داریم

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- ثبت و نگهداری تعداد زیاد مقالات و کتاب‌ها
- دسته‌بندی موضوعی منابع
- جستجوی سریع در میان فایل‌ها
- جلوگیری از خطا در ارجاع‌دهی
- تغییر خودکار سبک رفرنس‌دهی بر اساس الزامات ژورنال‌ها
- صرفه‌جویی در زمان نگارش مقاله و پایان‌نامه

استفاده از نرم‌افزارهای مدیریت منابع این فرایند را **دقیق، سریع و استاندارد** می‌کند.

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پژوهیار

نرم‌افزار فارسی
مدیریت و سازماندهی منابع علمی
یادداشت‌گذاری و برچسب‌گذاری
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EndNote

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سازگار با استانداردهای معتبر بین‌المللی

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ویژگی	EndNote	Mendeley
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مناسب برای	پژوهشگران حرفه‌ای و پایان‌نامه‌های بزرگ	دانشجویان و استفاده روزمره
ویرایش Style	بسیار پیشرفته و قابل شخصی‌سازی	محدودتر
تعداد Styleها	بسیار زیاد	کمتر
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فضای ابری و Sync	محدودتر	قوی‌تر
اشتراک‌گذاری گروهی	متوسط	بسیار مناسب
مدیریت PDF	خوب	بسیار خوب
ساخت Styleاختصاصی	کامل و حرفه‌ای	محدود
استفاده در ژورنال‌ها	بسیار رایج	کمتر
مناسب برای مقاله حرفه‌ای	عالی	خوب

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EndNoteیکی از حرفه‌ای‌ترین ابزارها برای پژوهشگران، دانشجویان و نویسندگان علمی است.

نقش EndNoteدر نگارش علمی

❑ در نگارش علمی معمولاً با این چالش‌ها مواجه هستیم:

- تعداد زیاد منابع
- تغییر مداوم ترتیب ارجاعات
- الزام ژورنال‌ها به سبک‌های مختلف رفرنس‌دهی
- احتمال خطای انسانی در ویرایش دستی

❑ **EndNoteاین مشکلات را به‌صورت خودکار مدیریت می‌کند.**

با هر تغییر در متن:

- شماره ارجاعات اصلاح می‌شود
- ترتیب منابع به‌روزرسانی می‌شود
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Historical perspective

Nanomaterial based PVA nanocomposite hydrogels for biomedical sensing: Advances toward designing the ideal flexible/wearable nanoprobes

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ABSTRACT

In today's world, the progress of wearable tools has gained increasing momentum. Notably, the demand for stretchable strain sensors has considerably increased owing to various potential and emerging applications like human motion monitoring, soft robotics, prosthetics, and electronic skin. Hydrogels possess excellent biocompatibility, flexibility, and stretchability that render them ideal candidates for flexible/wearable substrates. Among them, enormous efforts were focused on the progress of polyvinyl alcohol (PVA) hydrogels to realize multifunctional wearable sensing through using additives/nanofillers/functional groups to modify the hydrogel network. Herein, this review offers an up-to-date and comprehensive summary of the research progress of PVA hydrogel-based wearable sensors in view of their properties, strain sensory efficiency, and potential applications, followed by specifically highlighting their probes using metallic/non-metallic, liquid metal (LM), 2D materials, bio-nanomaterials, and polymer nanofillers. Indeed, flexible electrodes and strain/pressure sensing performance of designed PVA hydrogels for their effective sensing are described. The representative cases are carefully selected and discussed regarding the construction, merits and demerits, respectively. Finally, the necessity and requirements for future advances of conductive and stretchable hydrogels engaged in the wearable strain sensors are also presented, followed by opportunities and challenges.

1. Introduction

Nowadays, highly flexible soft electronics nanoprobes that can monitor health motions and conditions have attracted considerable attention for potential applications in soft robotics and wearable tools due to their comfort and convenient utilization [1,2]. Indeed, these sensors have capable of converting external stimuli like pressure and tensile to electrical signals such as voltage, capacitance, current, and resistance [3,4]. Skin-like wearable sensors are usually assembled from elastomers and conductive nanomaterials such as inorganic conductive particles, metal nanowires (NWs), carbon nanotubes (CNTs), and graphene, however, uniformly dispersion of fillers in the elastomer is problematic. As well, friction could occur between the conductive filler and the elastomer bringing on stress concentration, which significantly damages the mechanical property of the probe [5]. Therefore, introducing intrinsically conductive and flexible polymer-conductive nanomaterials with stability, biocompatibility, and superb mechanical properties has attracted people's attention [6,7]. In this regard, hydrogel-based flexible/wearable nanoprobes different from the rigid elastomer-based probes exhibit great potential in the sensory field by easily tuning the mechanical properties, network structure, and chemistry of the water-containing hydrogels to match those of bio-tissues, laying the foundation of designing of smart skins and implantable devices [8,9]. In addition, hydrogels are also one of the most reliable materials for other applications e.g. wound dressing, tissue engineering, drug delivery, water treatment [10,11], separation filter [12] rather than sensing [13] due to abundant hydrophilic intermolecular space for the entrance of other materials [14].

PVA hydrogel is a synthetic polymer that has sparked great interest in biomedical fields regarding its advantages such as biocompatibility, nontoxicity, biodegradability, hydrophilicity, and chemical stability. Significantly, the myriad of -OH groups on PVA could result in the

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stick to the skin in the detection process but also promote the reception of the ion current generated in the cells through the hydrating cuticle of the skin epidermis. At this state, Wang and coworkers [175] fabricated a flexible conductive electrode using PVA-based PEDOT: PSS/cellulose hydrogel to monitor the ECG signals. For that, PEDOT: PSS was formed in the process of oxidative polymerization of PVA and cellulose substrates. The fibers with micron-level and linear at the beginning of dissolution had a uniform thickness and was orderly arranged. Also, the change in gel film from white to black during the oxidation process over time has been observed. By controlling the PEDOT content, it has been revealed that the conductivity of the composite hydrogel could be accurately optimized. Also, no skin irritation was detected during the signal measurement. This strategy could promisingly explore the application of PEDOT: PSS/cellulose/PVA film in constructing eco-friendly conductive electrodes for ECG monitoring due to admirable features of stability, comfortable contact with skin, low skin contact impedance, and flexibility.

3. Conclusions and outlook

Recently, the progress of nanocomposite hydrogel as an effective nano-platforms for monitoring human motion and electronic skin has witnessed excessive advancement. Herein, we aim to offer a comprehensive review discussing concepts and current progress in the development of PVA nanocomposite hydrogel-based sensors, involving design strategies, preparation approaches, and their applications. PVA nanocomposite hydrogels are emerging newfangled materials that possess the properties of both soft matter gel and nanomaterials. Hence, a number of studies comprising synthesis and physicochemical were pursued. The microporous and hydrophilic building of the PVA hydrogels appears to be an incredible host for NPs. In this context, the recent trends in incorporating inorganic NPs, like carbon-based, LMs, 2D materials, metal/MO, and polymer-based nanomaterials, into 3D polymeric networks as nanocomposite gels with appropriate functionalities for adaptation to complex environments, are discussed. We specially outlined those PVA/NPs nanoprobes that are capable of identification in complex media or those using novel constructions/approaches. As more materials are advanced toward realizing particular characteristics and buildings, PVA/NPs based hydrogel would attract further intensive notice as functional nanoprobes. PVA-based nanoprobes with high mechanical characteristics have facilitated the construction of (bio)sensors, flexible electronic devices, and biomedicine fields, which in turn their performance relies considerably on the type and content of the NPs. Particularly, the high conductive feature of this nanostructure permits them to use in (bio)sensors, actuators, supercapacitors, electro-skin, and drug delivers. Although various inspiring results were recently described for PVA/NPs based hydrogel to realize high conductivity and stretchability, their use often involves the phenomenon of agglomeration, which requires more studies for precise control and development as a comprehensive technique. In addition, the relatively poor interfacial interactions between the NPs and polymers considerably induced the low structural stability and mechanical features of the hydrogels. So, exploring the NPs surface modification remains an imperative method to improve their interfacial interaction with polymer via well-designed bonding and structure. Additionally, the industrial-scale fabrication of the nanocomposite is still challenging.

Nowadays, progress in processing approaches, for example, microfluidic reactors, 3D printing technologies, dynamic cross-linking spinning, and extrusion, afford extensive chances to advance large-scale PVA/NPs based hydrogel with designed configurations. In this perspective, PVA/NPs based hydrogel can be incorporated with 3D printing as a molding fabricating strategy that can facilitate their fabrication and effective implementations in different device applications. However, no significant progress has yet been made on the printing of PVA nanocomposite hydrogels. The main reason is that 3D printing technologies have a high demand for material performance, such as the viscosity/melting point of the material, the photocurable material features, and their capability to maintain the shape after extrusion. To sum up, we believe that with the continued improvement of procedures from the design to production of PVA/NPs based hydrogel, novel kinds of these hydrogels with arranged buildings, new responses to stimuli, and brilliant mechanical characteristics can come true in the near future for use in the fields of (bio)sensors, actuators, biomedicine, and biomimetic materials.

Declaration of Competing Interest

The authors declare no conflict of interest.

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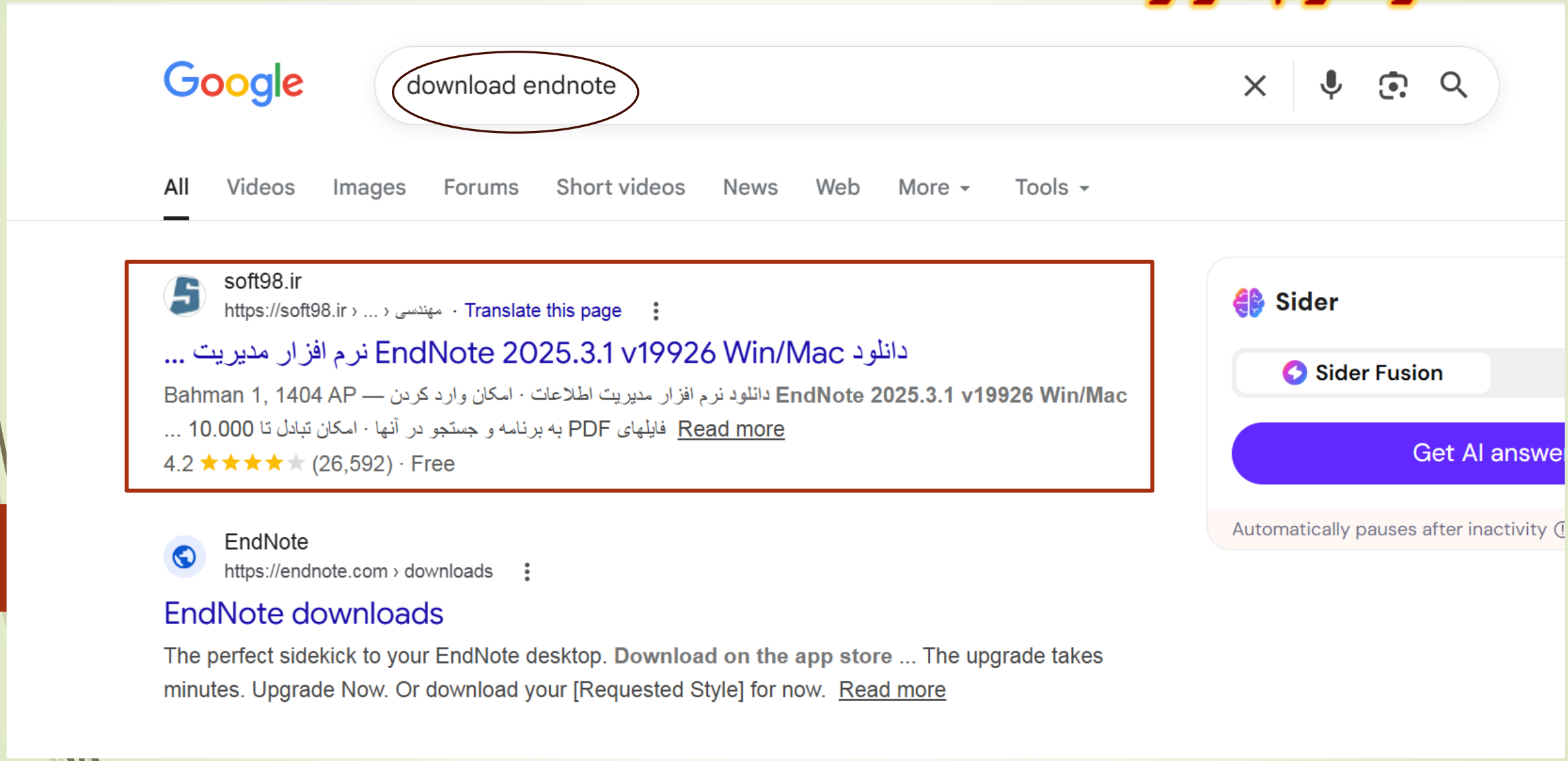

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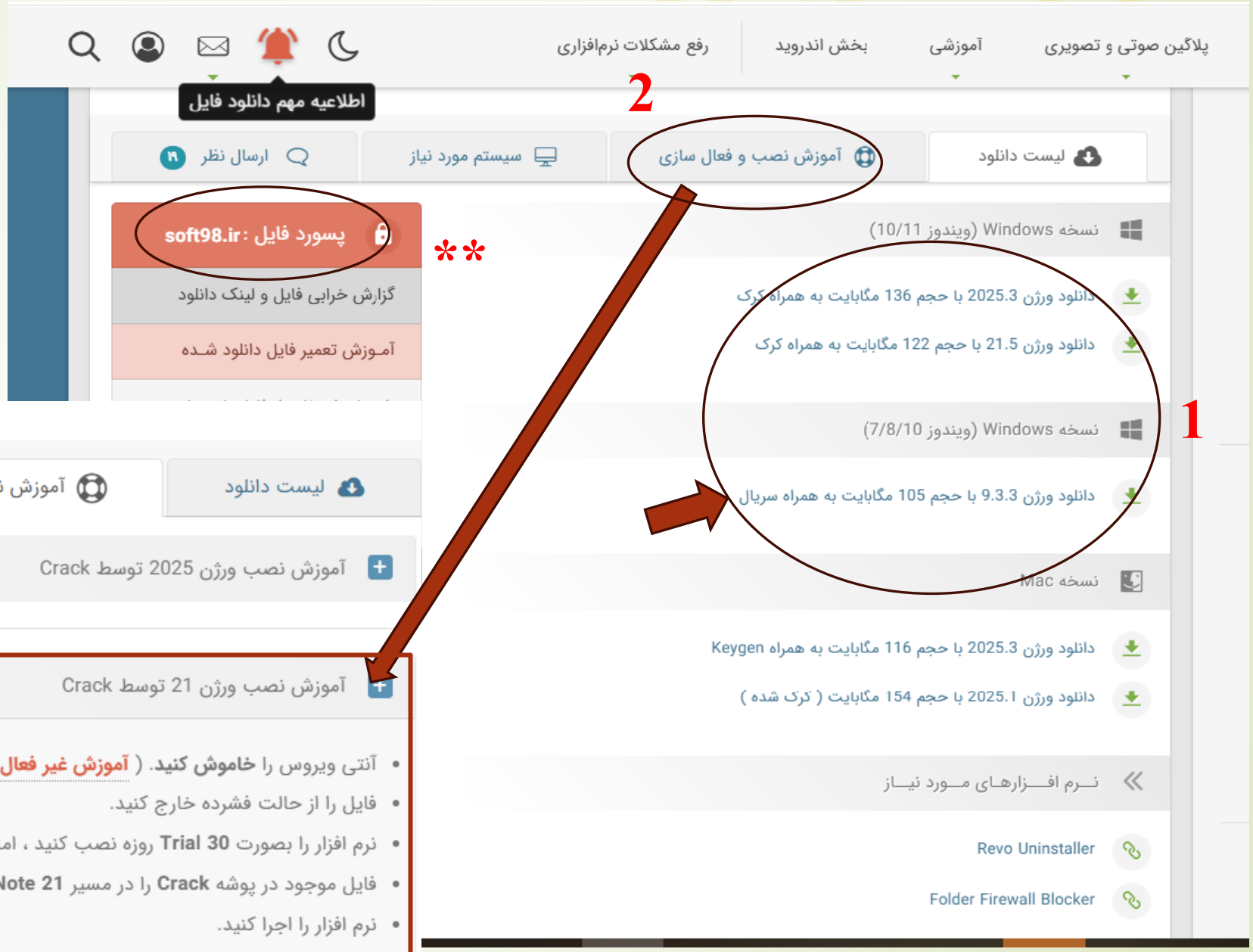

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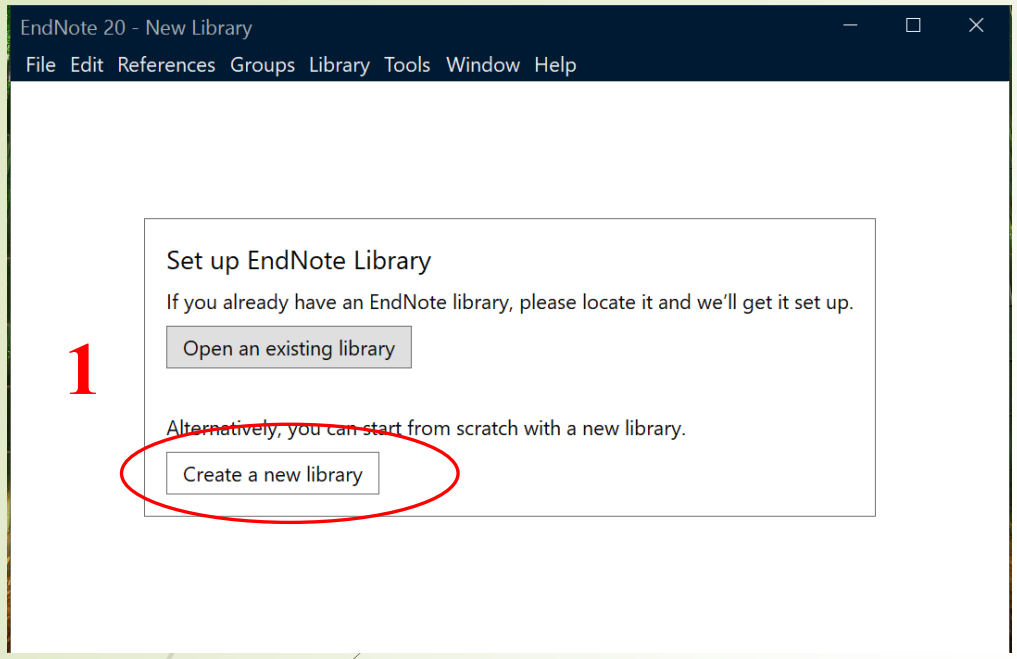

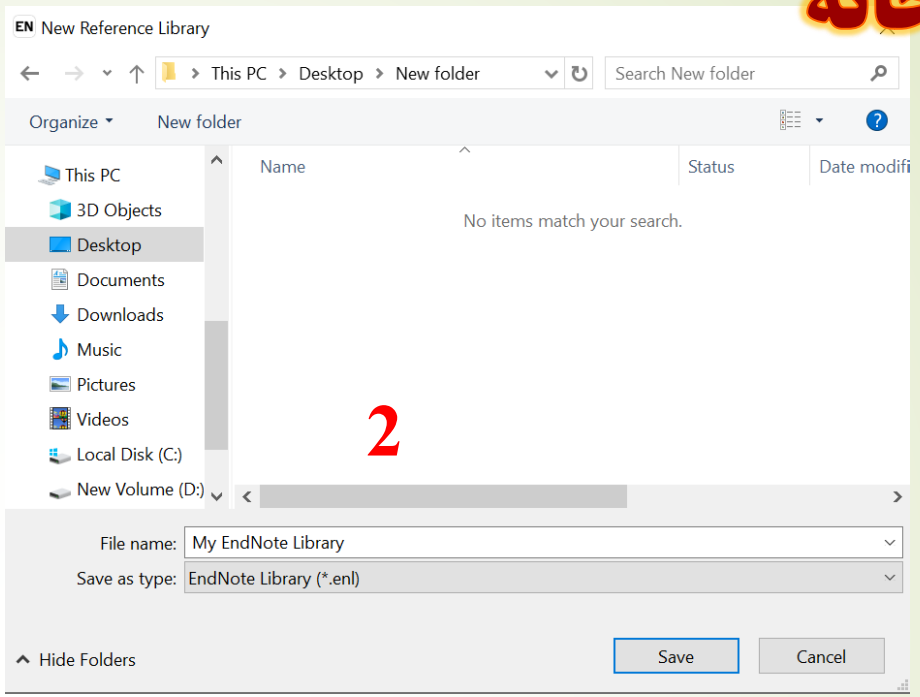

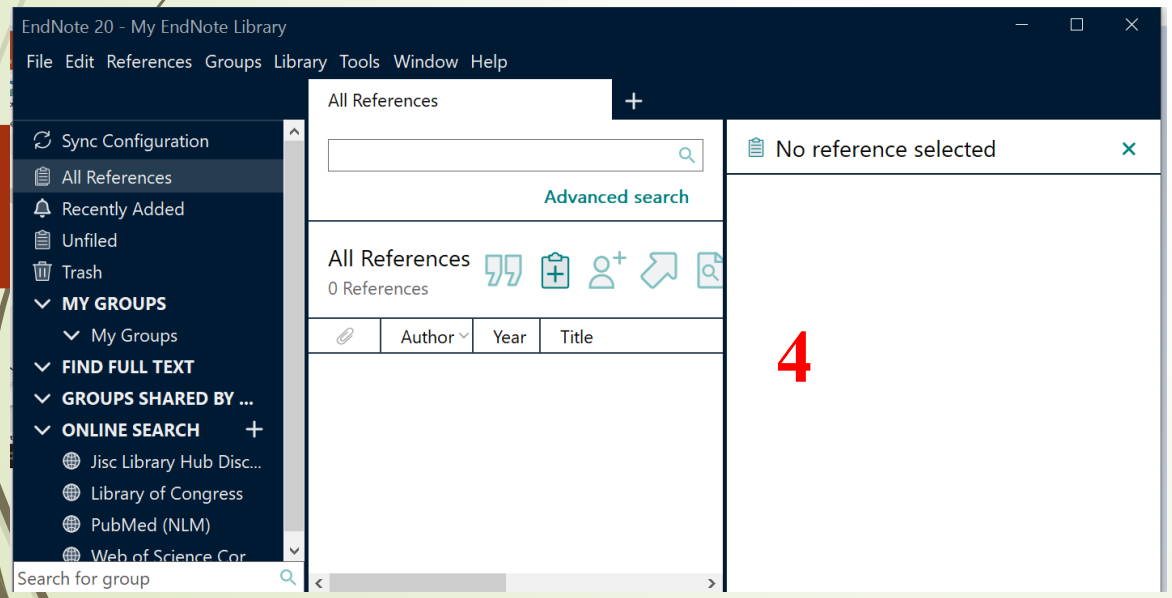

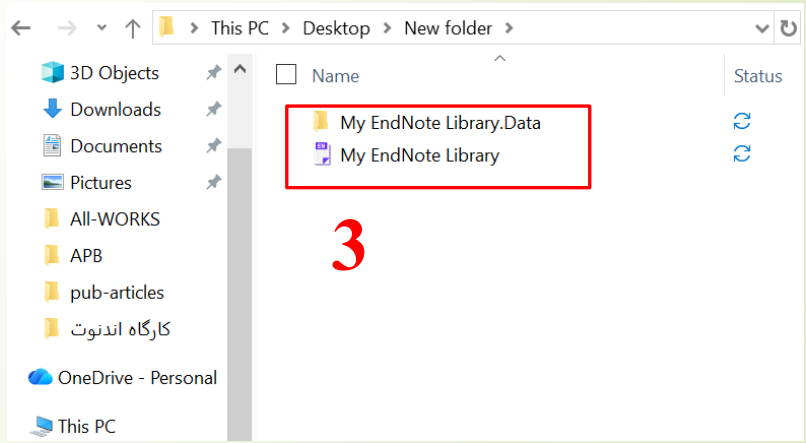

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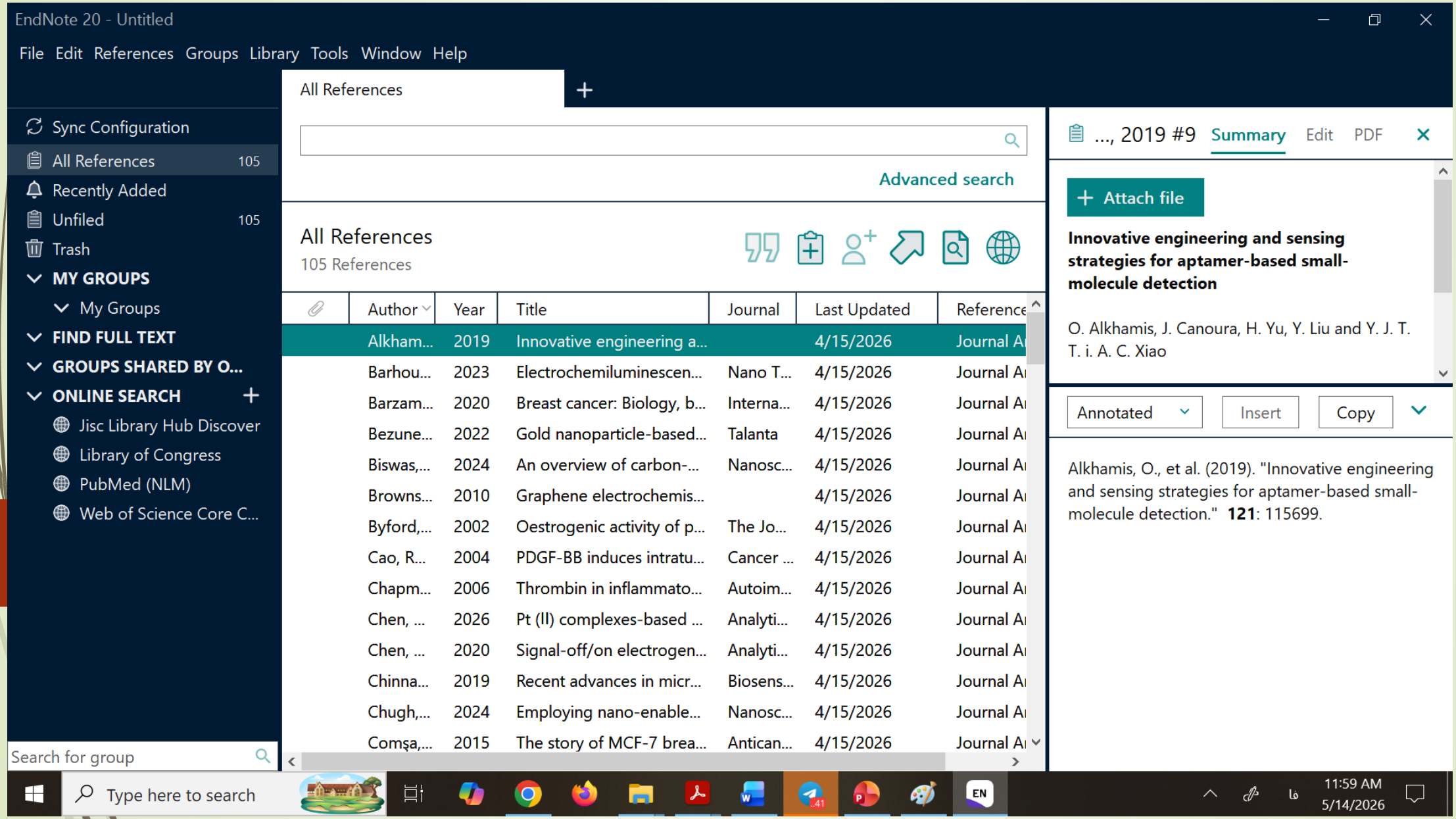

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Chicago — Darwish, Moustafa A., Walaa Abd-Elaziem, Ammar Elsheikh, and Abdelhameed A. Zayed. "Advancements in nanomaterials for nanosensors: a comprehensive review." *Nanoscale Advances* 6, no. 16 (2024): 4015-4046.

Harvard — Darwish, M.A., Abd-Elaziem, W., Elsheikh, A. and Zayed, A.A., 2024. Advancements in nanomaterials for nanosensors: a comprehensive review. *Nanoscale Advances*, *6*(16), pp.4015-4046.

Vancouver — Darwish MA, Abd-Elaziem W, Elsheikh A, Zayed AA. Advancements in nanomaterials for nanosensors: a comprehensive review. Nanoscale Advances. 2024;6(16):4015-46.

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nova A, Rahmani K, Wang J, Jahed Z.

Nat Nanotechnol. 2025 Oct;20(10):1374-1387. doi: 10.1038/s41565-025-02032-w. Epub

PMID: 41094263 Review.

We further consider the integration of these **nanosensors** into three-dimensional, physiologically relevant models such as organoids to create 'smart organoids' that report on their internal state autonomously and in real time. ...

2

2 Cite

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Sharma S, Gupta S, Saini AK, Saini RV, Kaushal A.

Talanta. 2025 Aug 15;291:127830. doi: 10.1016/j.talanta.2025.127830. Epub 2025 Feb 25.

PMID: 40054216 Review.

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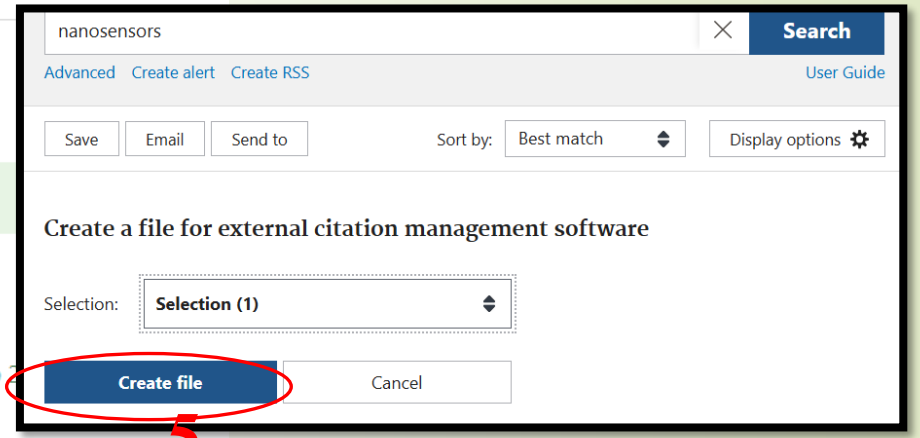

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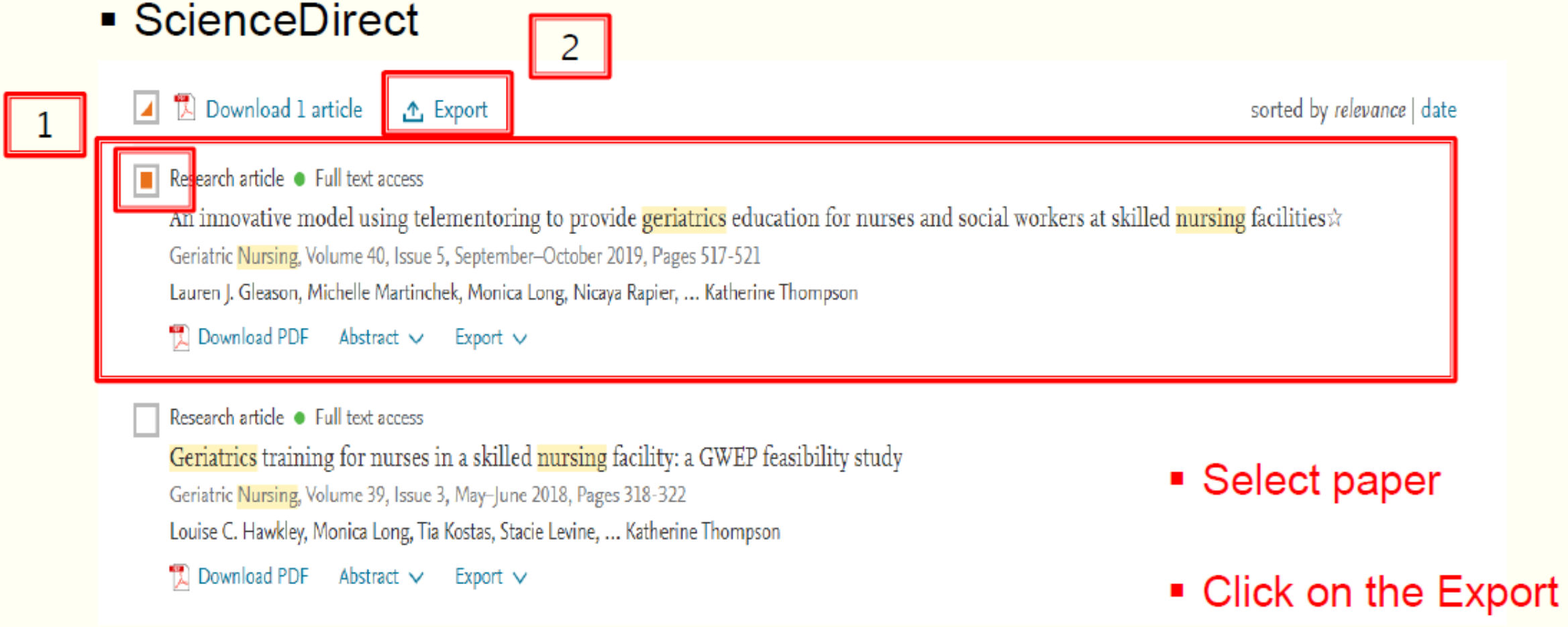

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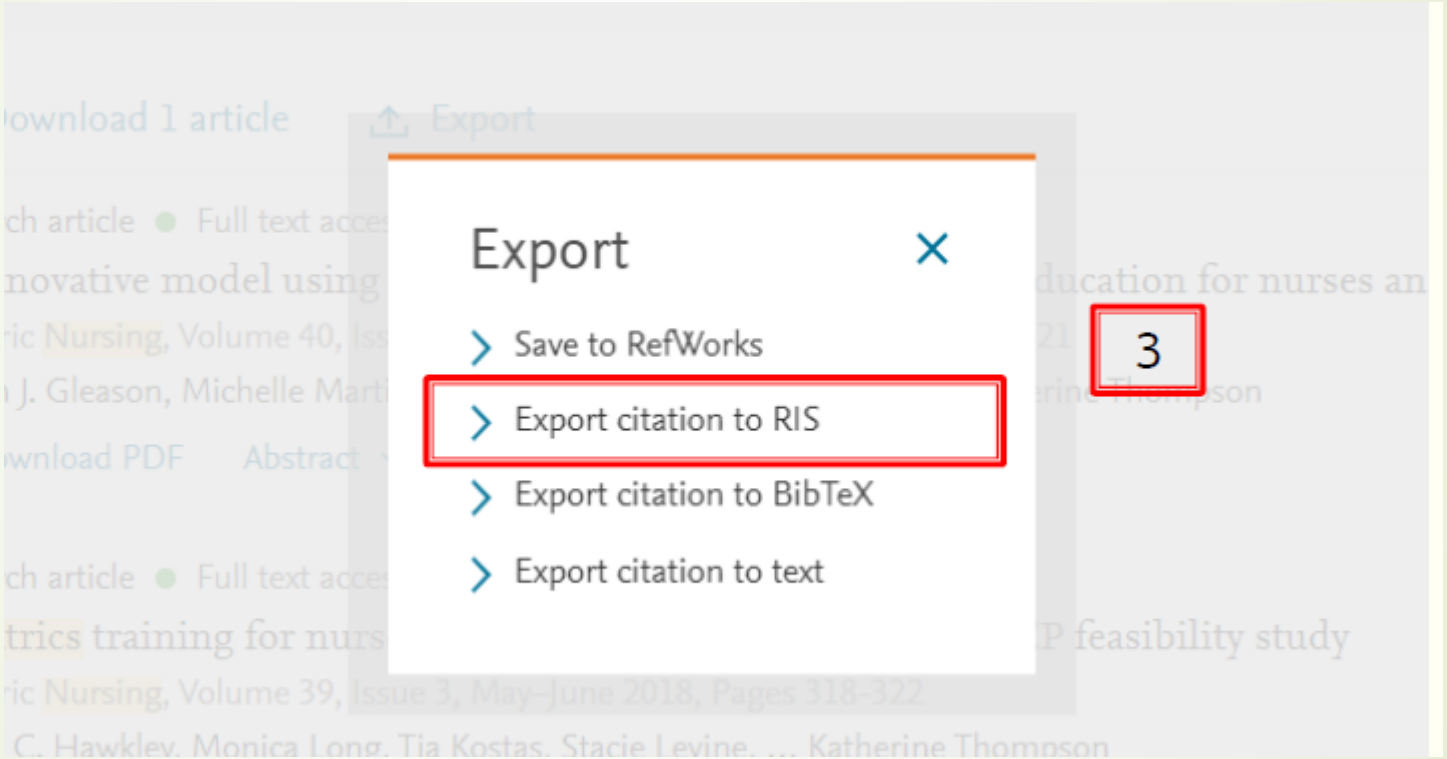

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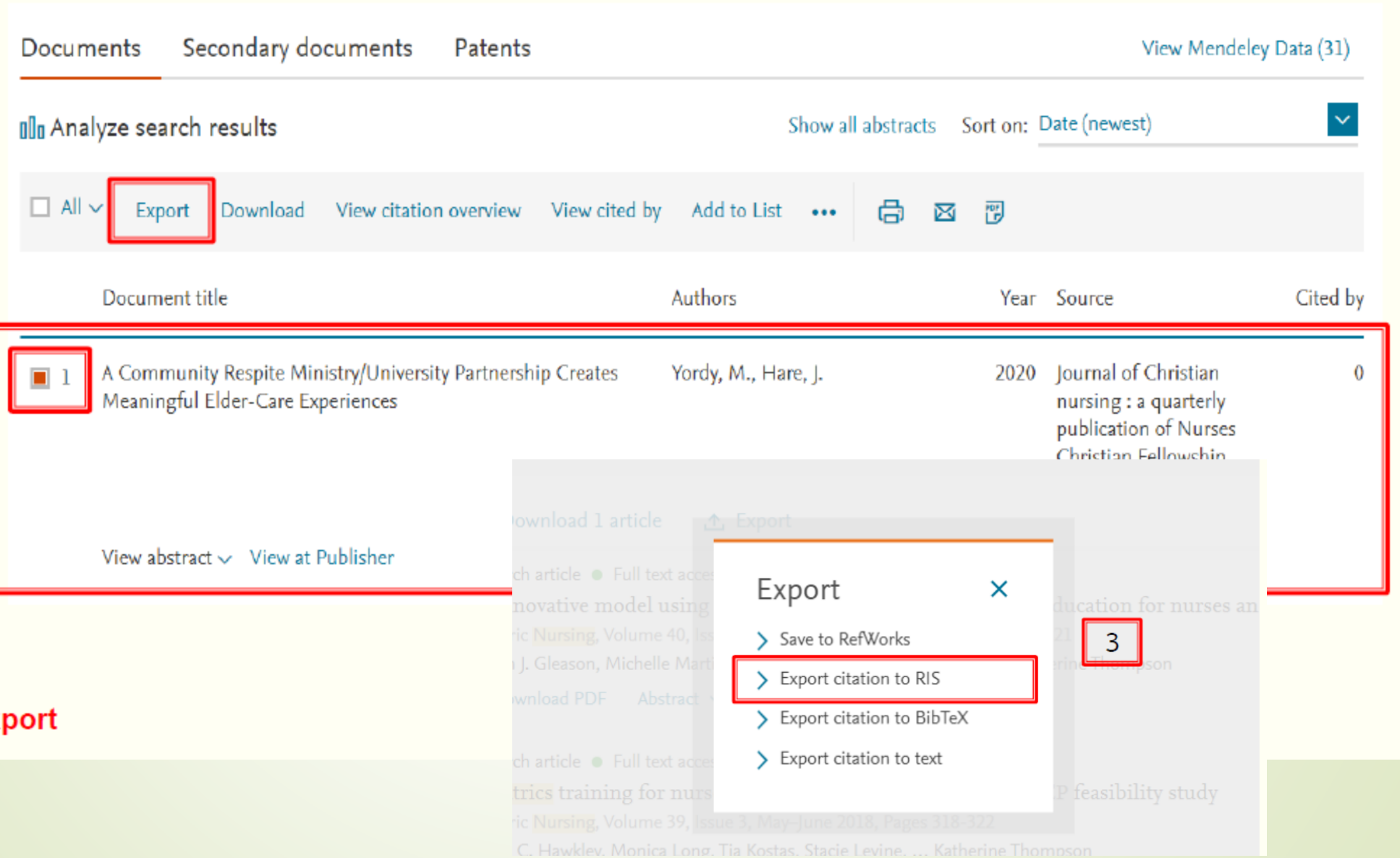

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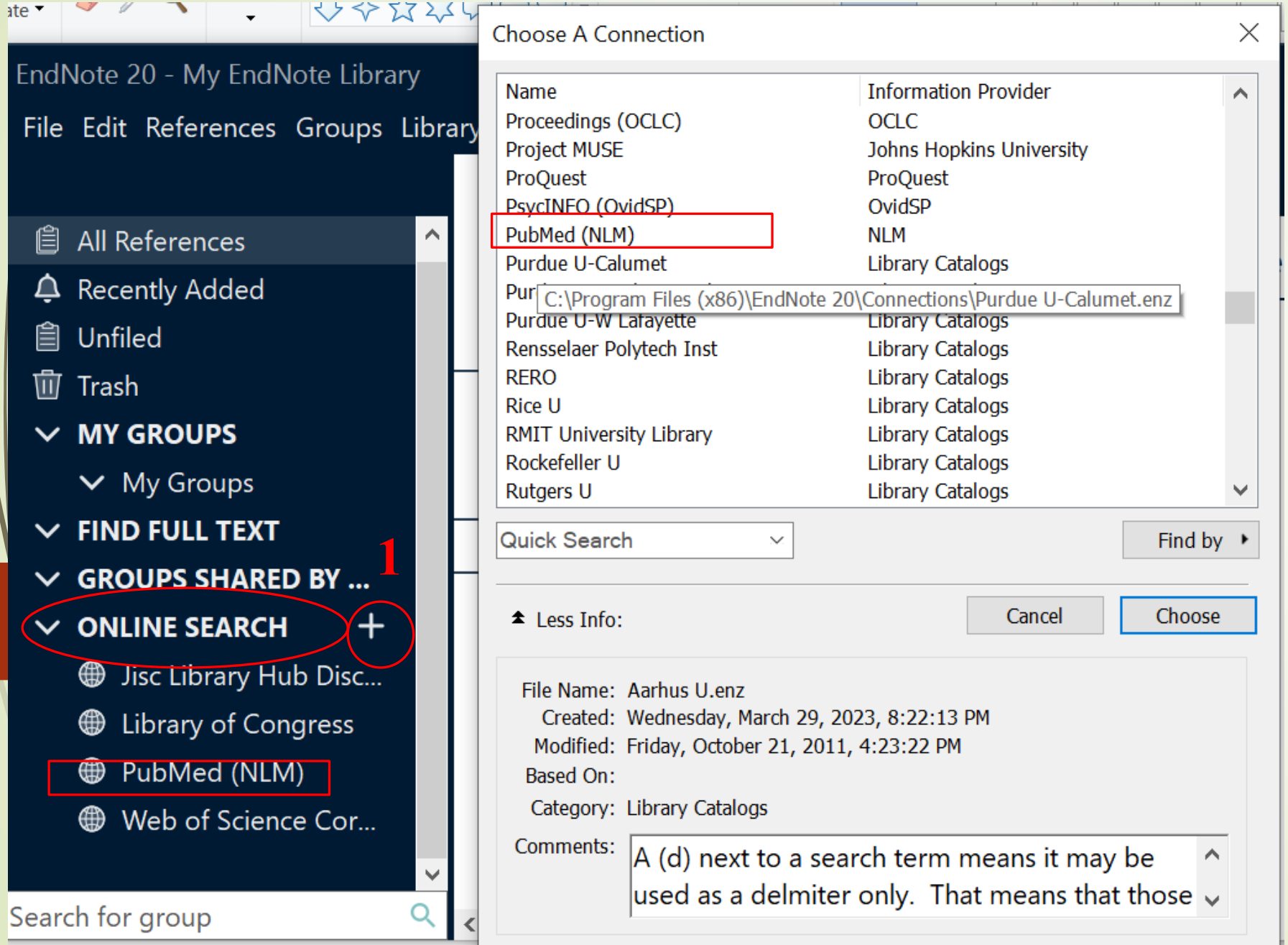

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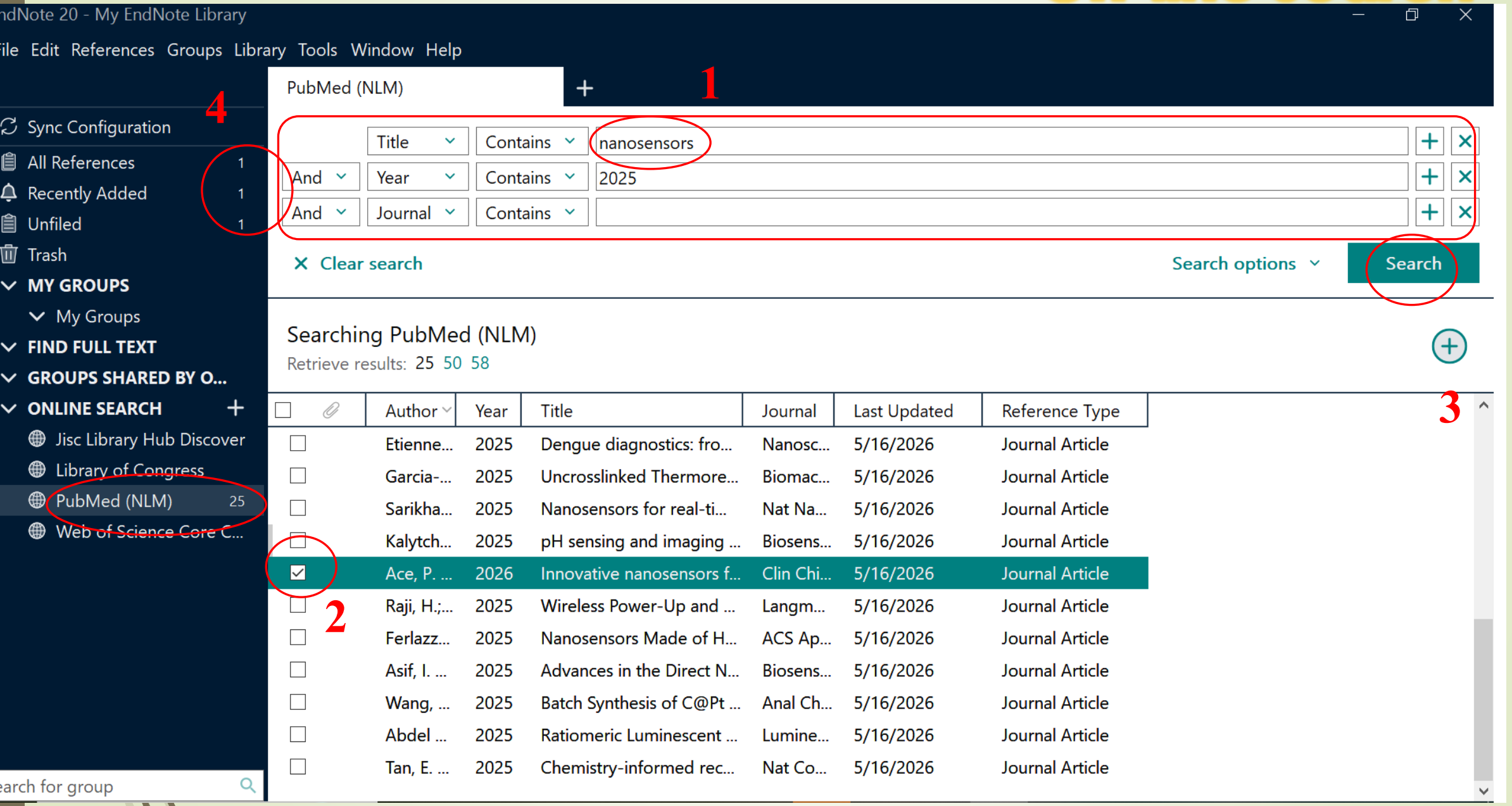

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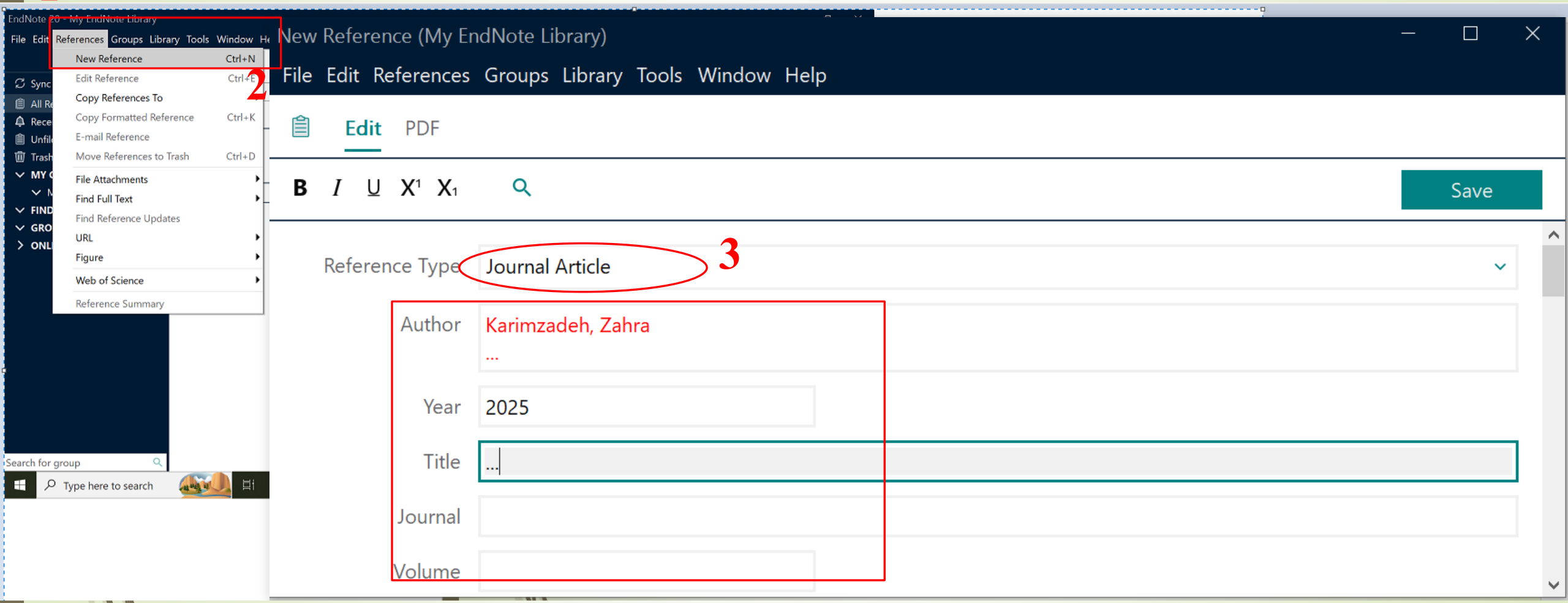

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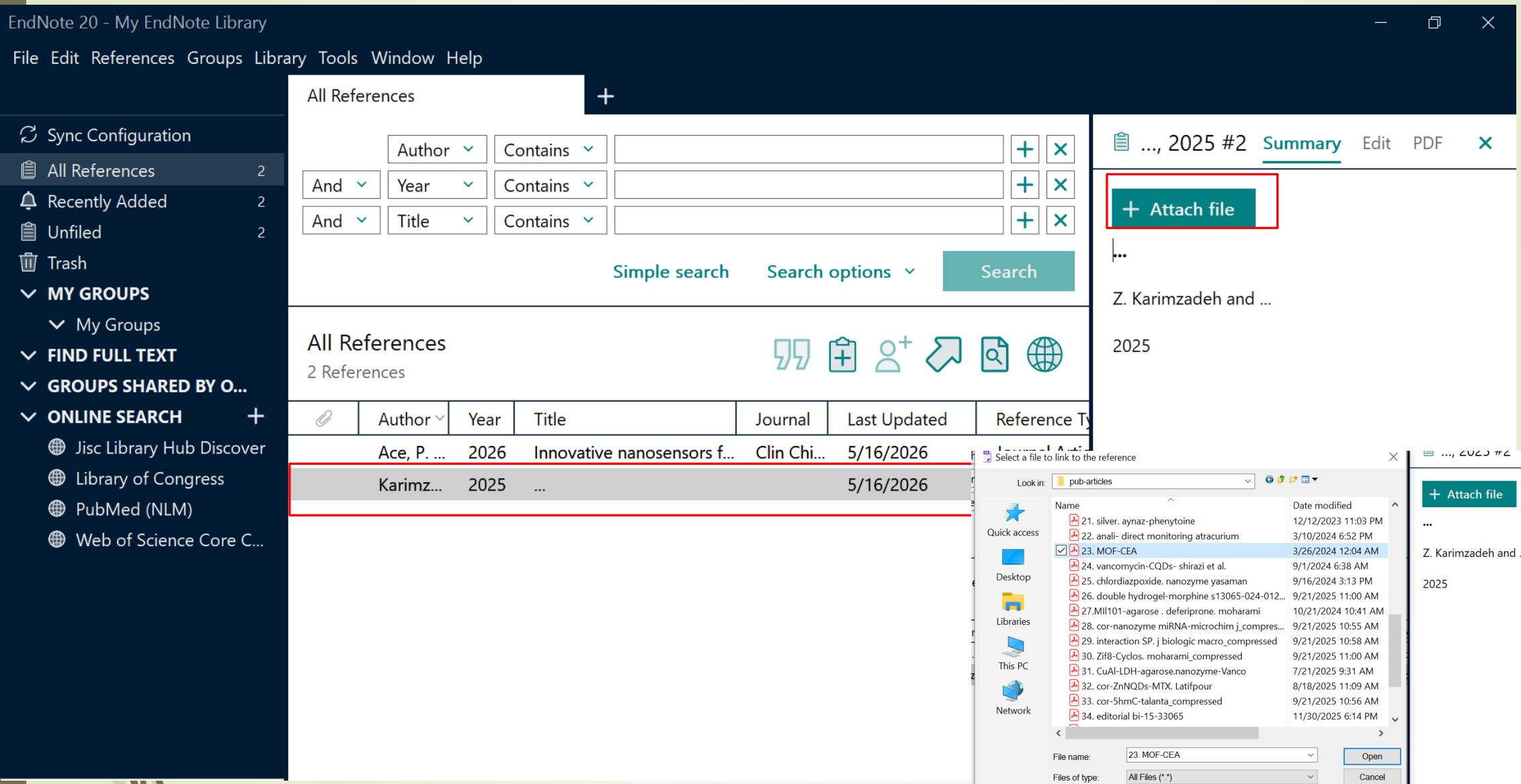

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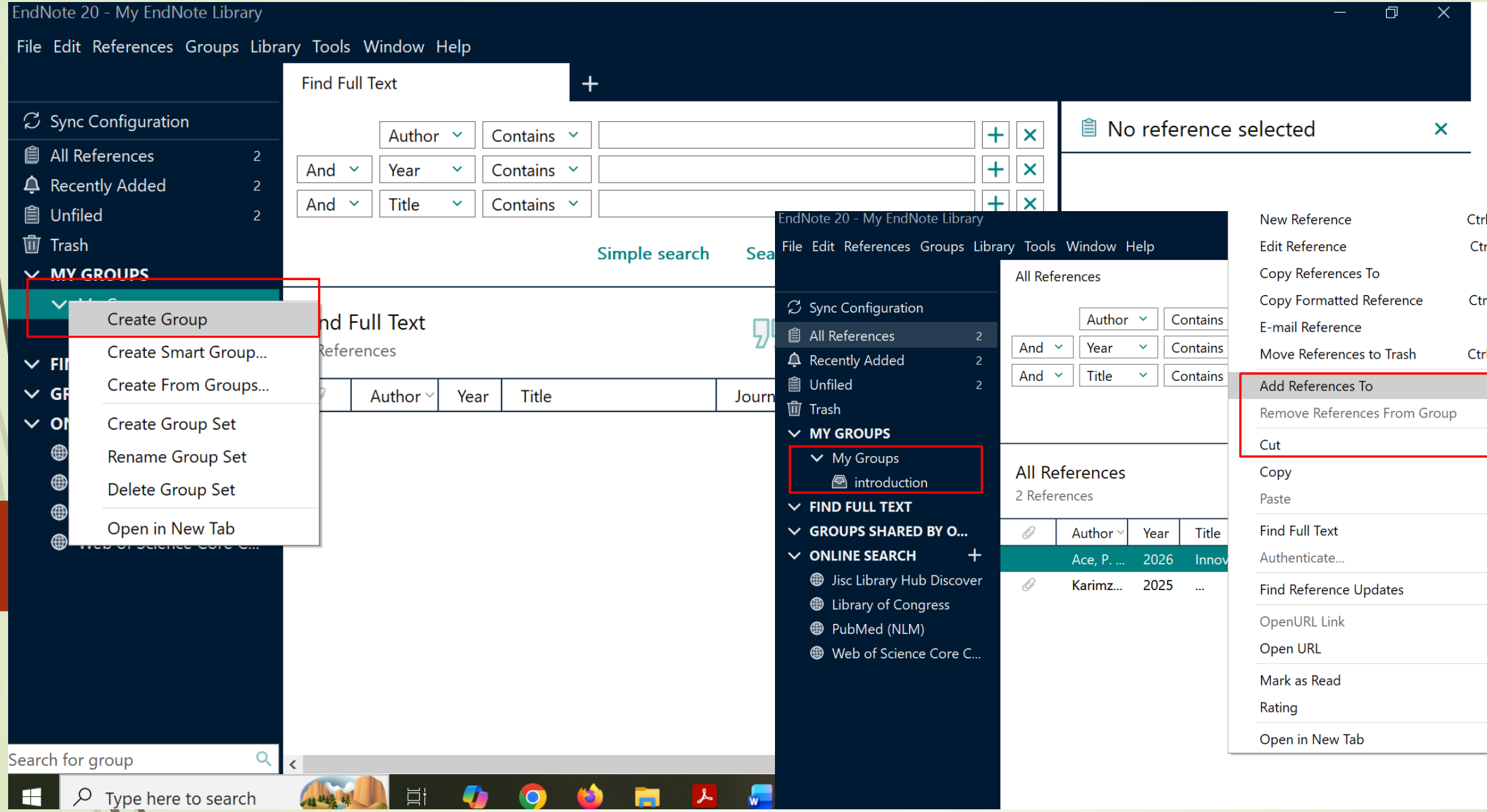

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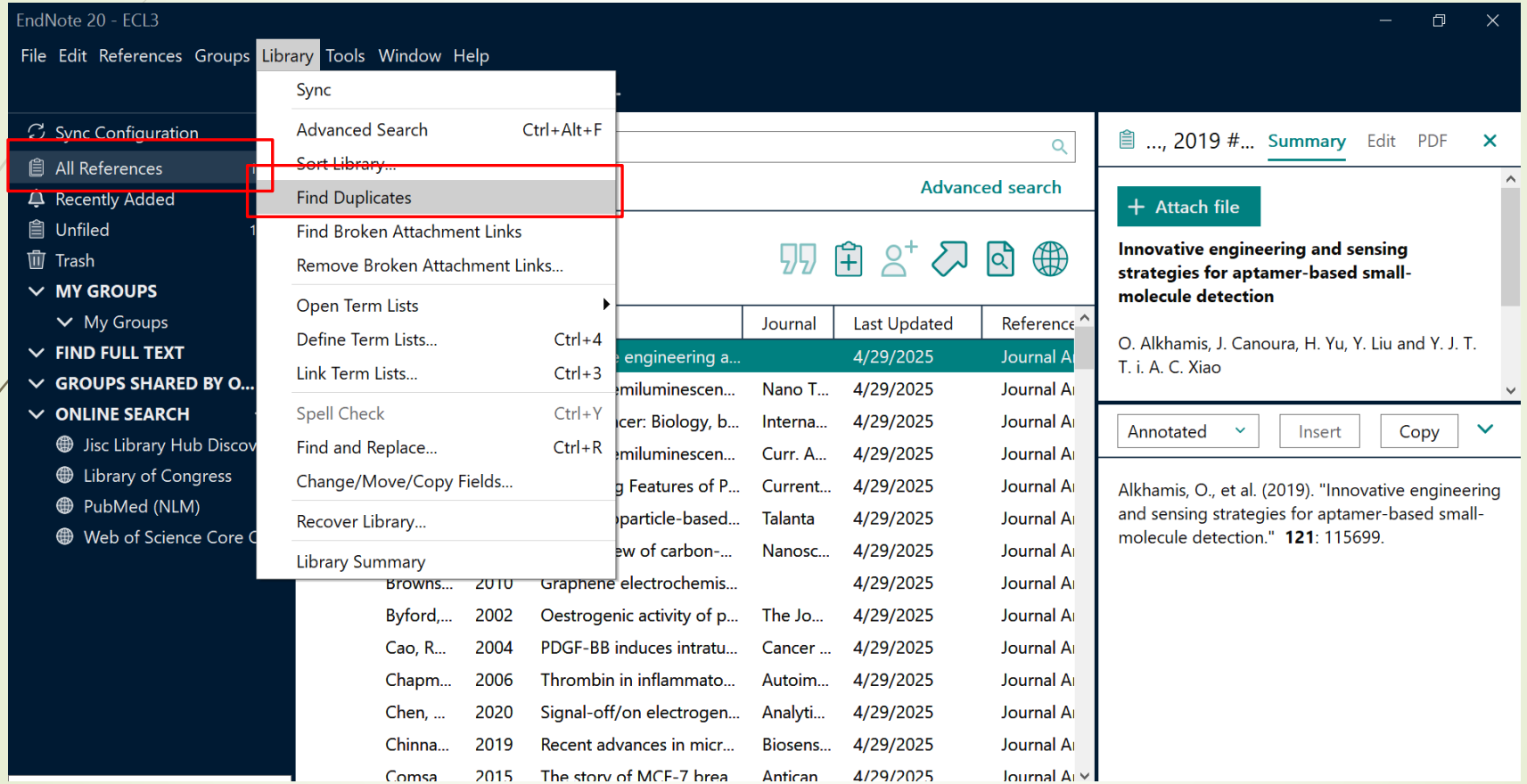

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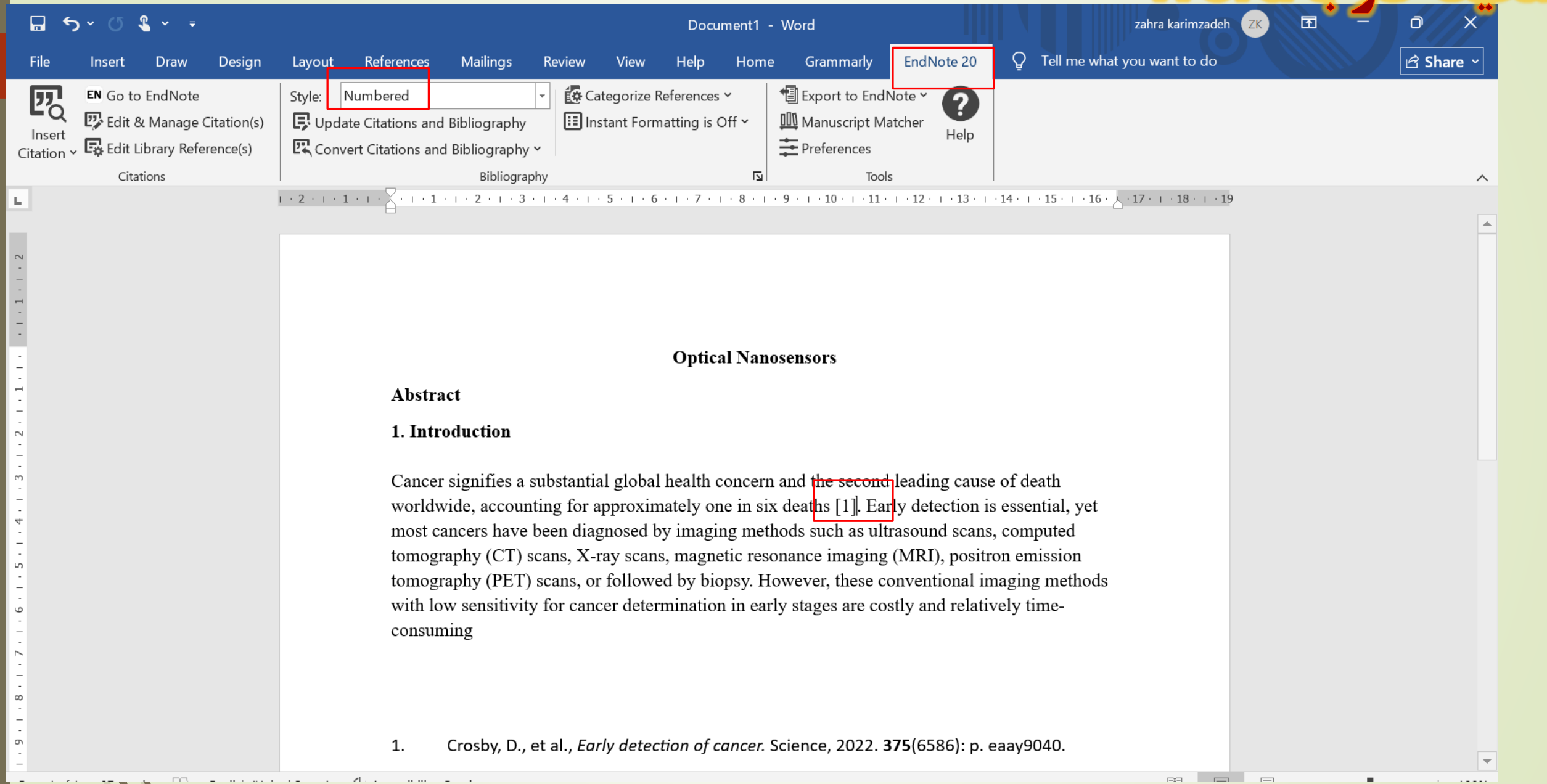

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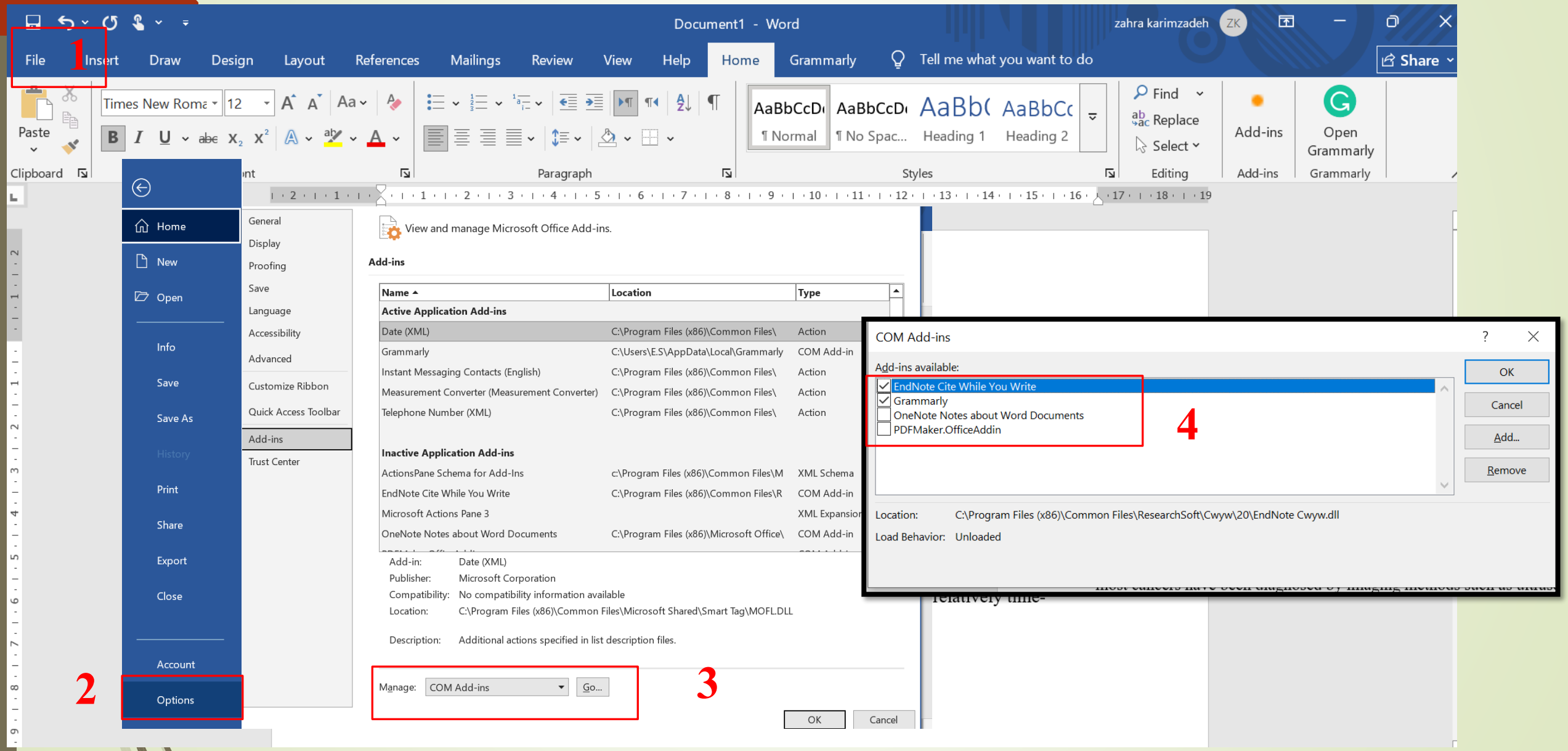

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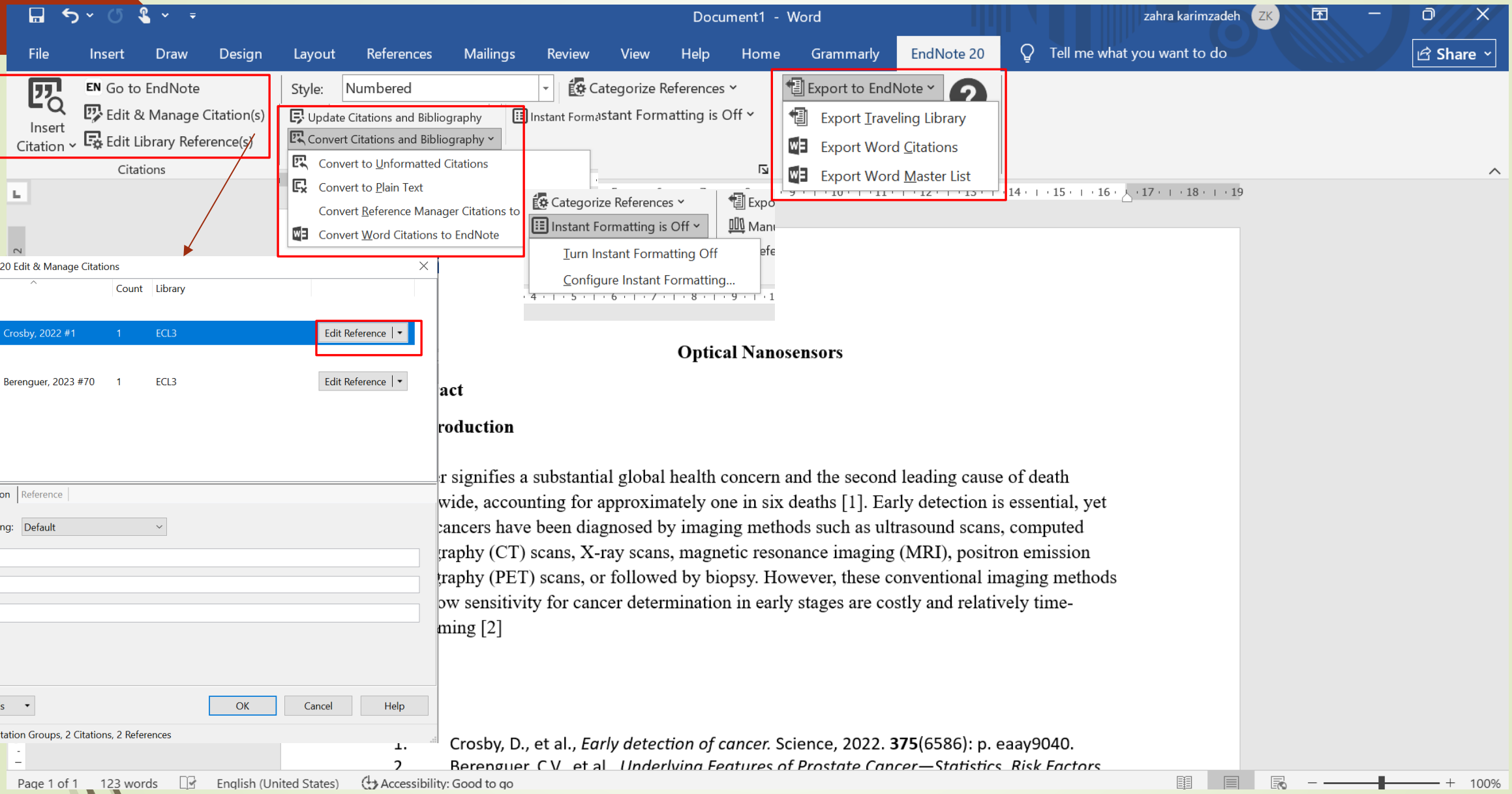

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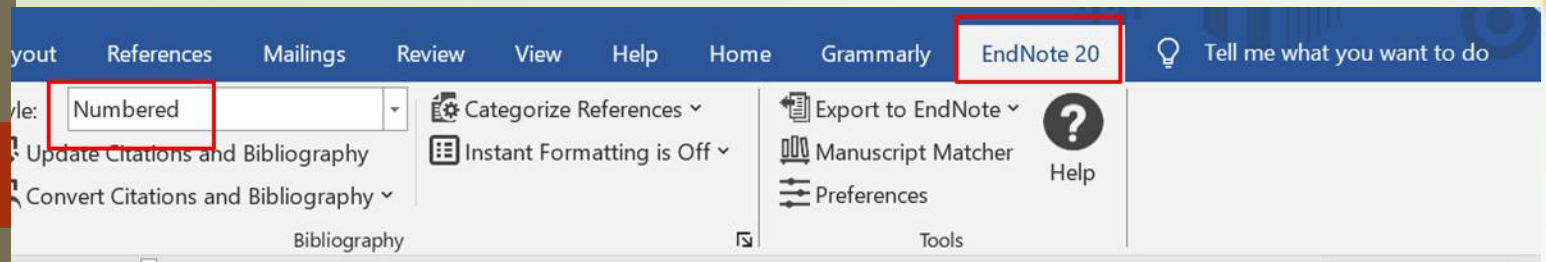

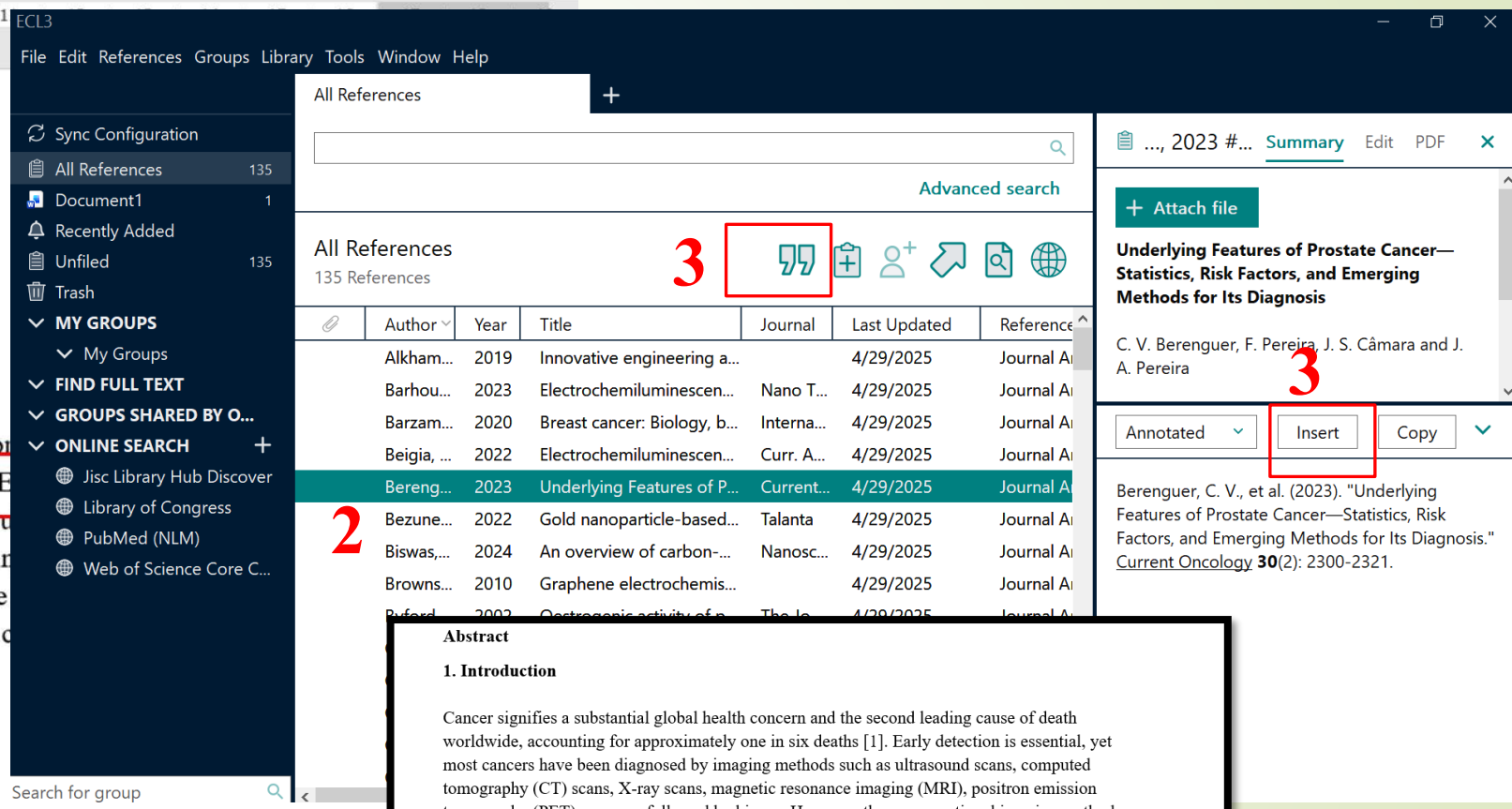

Optical Nanosensors

Abstract

1. Introduction

Cancer signifies a substantial global health concern and the secon
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most cancers have been diagnosed by imaging methods such as u
tomography (CT) scans, X-ray scans, magnetic resonance imagin
tomography (PET) scans, or followed by biopsy. However, these
with low sensitivity for cancer determination in early stages are c
consuming

1

1. Crosby, D., et al., *Early detection of cancer.* Science, 2022. **375**(6586): p. eaay9040.

Abstract

1. Introduction

Cancer signifies a substantial global health concern and the second leading cause of death worldwide, accounting for approximately one in six deaths [1]. Early detection is essential, yet most cancers have been diagnosed by imaging methods such as ultrasound scans, computed tomography (CT) scans, X-ray scans, magnetic resonance imaging (MRI), positron emission tomography (PET) scans, or followed by biopsy. However, these conventional imaging methods with low sensitivity for cancer determination in early stages are costly and relatively time-consuming [2]

4

1. Crosby, D., et al., *Early detection of cancer.* Science, 2022. **375**(6586): p. eaay9040.
2. Berenguer, C.V., et al., *Underlying Features of Prostate Cancer—Statistics, Risk Factors, and Emerging Methods for Its Diagnosis.* Current Oncology, 2023. **30**(2): p. 2300-2321.

شیوه ها یا انواع استناد

1. **برون متنی (شمارشی):** سند مورد ارجاع در جایی خارج از متن

(پایین صفحه، پایان فصل یا انتهای متن) درج می‌شود. رفرنس‌ها به صورت نماد عددی در متن می‌آیند. مانند شیوه ونکوور

2. **درون متنی (نام– سال):** مشخصات کوتاهی از رفرنس در داخل پرانتز در متن ارائه می‌شود که اغلب شامل نام نویسنده و تاریخ و مواردی شماره صفحه است. مانند شیوه هاروارد و شیوه ای. پی. ای. (انجمن روانشناسان امریکا)

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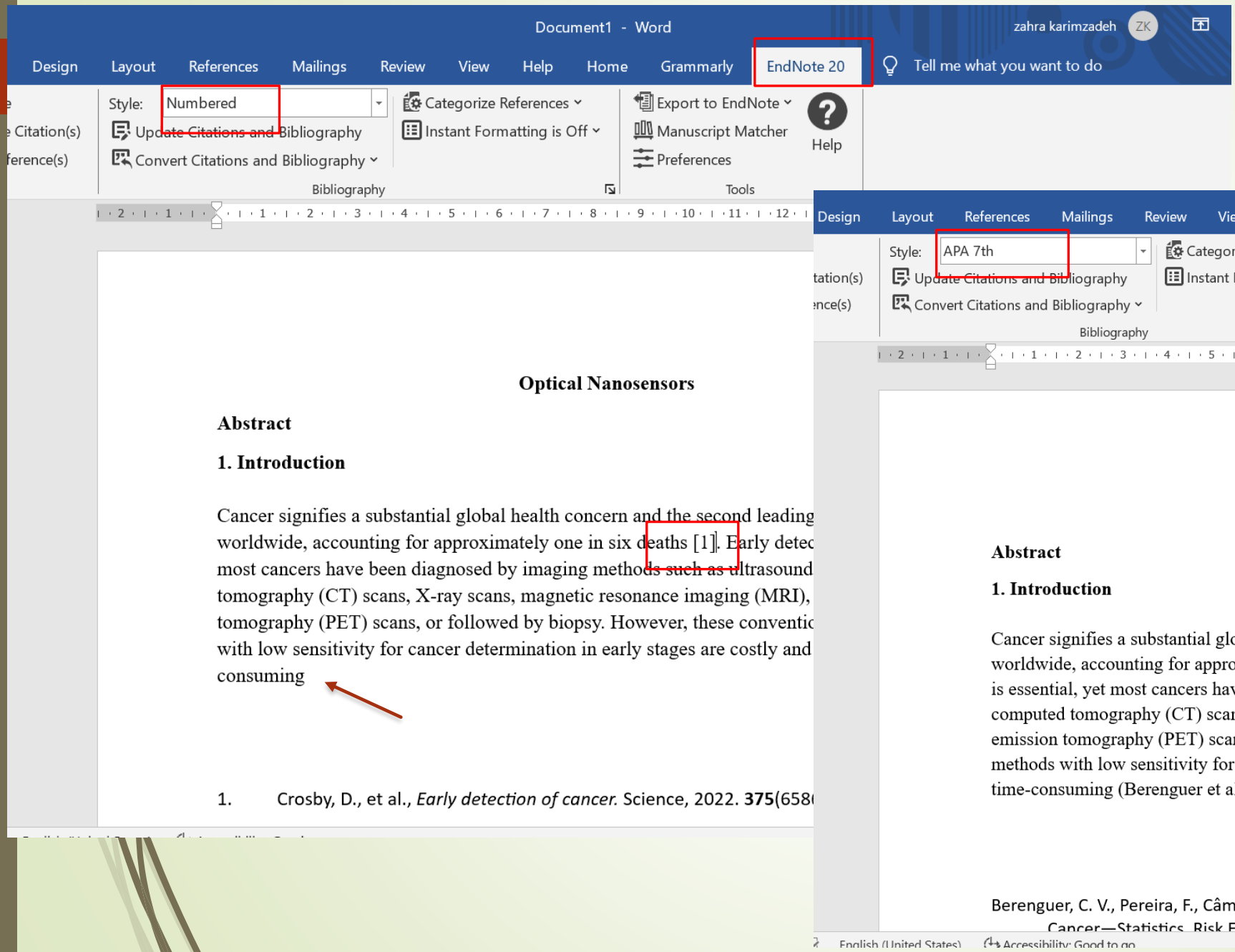

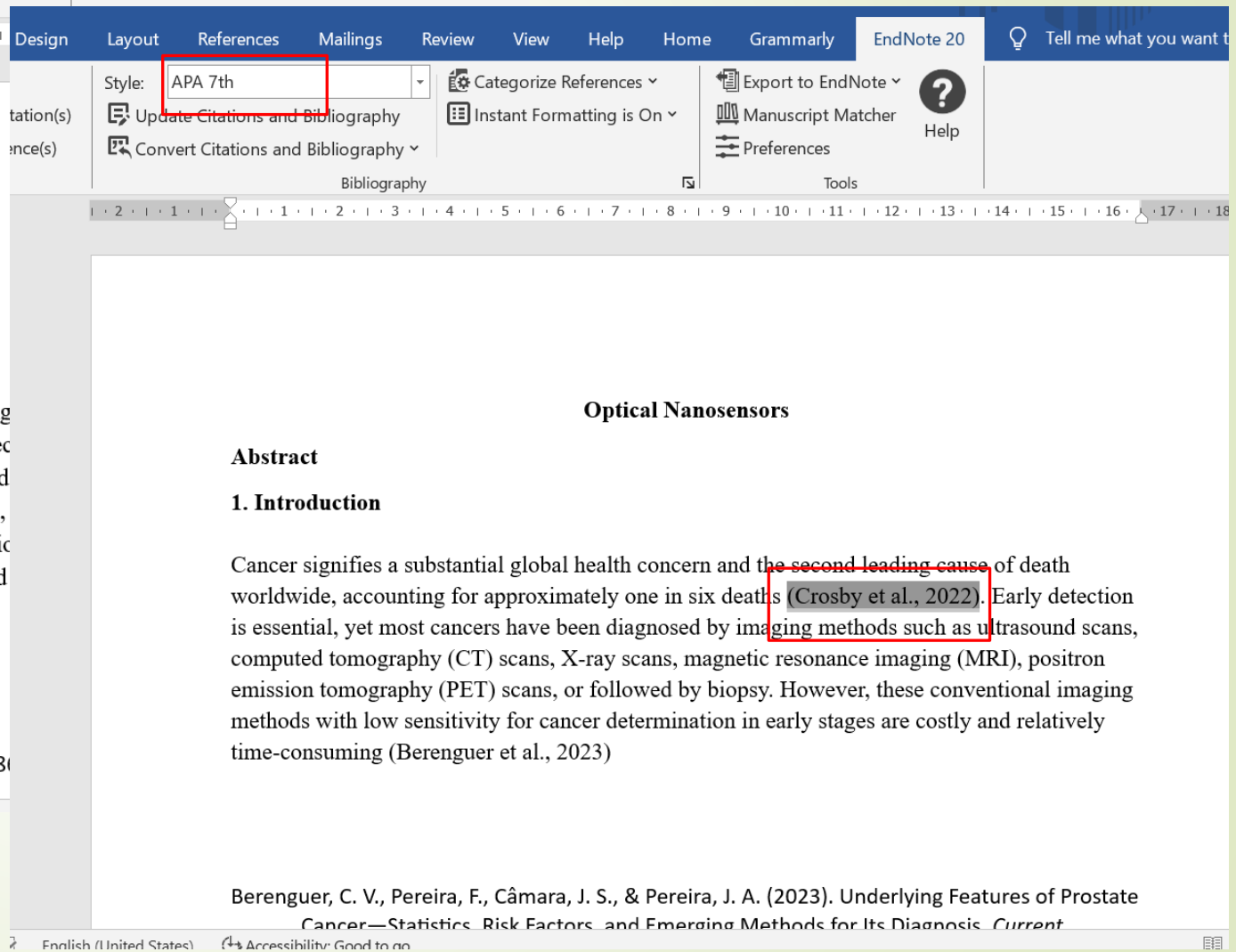

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- هاروارد (درون متنی)
- APA

رفرنس دهی به سبک ونکوور Vancouver

تاریخچه:

اولین بار در سال ۱۹۷۸ گروه کوچکی از سردبیران مجلات پزشکی در ونکوور بریتیش کلمبیا برای تهیه راهنمای نگارش مقالات ارائه شده در مجلات پزشکی گرد هم جمع شدند. این گروه به نام گروه ونکوور شناخته شد. حاصل این گردهمایی در سال ۱۹۷۹ مشتمل بر راهنمای نگارش فهرست منابع توسط کتابخانه ملی پزشکی آمریکا ارائه شد. با توسعه این گروه, کمیته بین المللی سردبیران مجلات پزشکی شکل گرفت. این کمیته ویرایشهای متعددی از " قوانین یکدست و هماهنگ جهت نوشته های ارائه شده به مجلات زیست پزشکی " تهیه و چاپ کرد که بطور کامل در سال ۱۹۹۷ تجدید نظر شد و ویرایش اصلی و نهایی آن در سال ۲۰۰۱ به اتمام رسید.

هم اکنون بیش از ۵۰۰ نشریه حوزه علوم پزشکی از این قوانین پیروی می کنند.

اصول مربوط به شیوه ونکوور:

وقتی که به هر منبع ، عددی اختصاص می دهید، هربارکه در متن مجددا می خواهید به آن منبع استناد کنید، باید همان عدد را درج نمایید.

به عنوان یک قاعده کلی، این اعداد بعد از **نقطه و کاما در آخر هر جمله و داخل پرانتز** قرار می گیرند.

وقتی در بخشی از متن به چند منبع (که شماره های آنها، متوالی و پشت سر هم است) استناد کنید، از خط فاصله (-) برای توالی اولین عدد و آخرین عدد استفاده کنید. مثل : (۸-۳)

وقتی در بخشی از متن، به چند منبع (که شماره های آنها پشت سرهم نیست) می خواهید استناد کنید، بین هر شماره با شماره بعدی، یک علامت ویرگول و بدون فاصله قرار دهید. مثل: (۸، ۷، ۶ ، ۲)

رفرنس نویسی APA

American Physiological Associations

تاریخچه:

برای سهولت در نگارش، انجمن روانشناسان آمریکا، شیوه نگارش APAرا پیشنهاد دادند که بیش از دو دهه است در جهان مرسوم شده است.

در شیوه APAمشخصات مطلب نقل شده به صورت خلاصه نام خانوادگی، سال انتشار و صفحه در پرانز مقابل عبارت ها نوشته می شود و مشخصات جامع منبع شامل نام خانوادگی ، نام، سال انتشار، نام کتاب یا مقاله، احتمالا مترجم، انتشارات و شماره چاپ بر اساس حروف الفبا در انتهای نوشتار آورده می شود.

رفرنس نویسی به سبک هاروارد

- ذکر نام نویسنده و سال چاپ در پرانتز: (هال، ۱۹۸۸)
- ذکر نام نویسنده به عنوان بخشی از جمله: هال (۱۹۸۸) نشان داد که...
- ذکر چند منبع مشترک (به ترتیب زمانی با گذاشتن علامت ویرگول)
- ذکر دو منبع با نویسنده و سال انتشار مشابه

(هال، 1988a) و (هال، 1988b)

- ذکر نام بیش از دو نویسنده: در اولین نوبت ذکر منبع، نام هر دو می آید، پس از آن فقط نام نویسنده اول و کلمه et al

بخشی از یک کتاب

- ونکوور:

Porter RJ. Antiepileptic drugs, In: Katzung BG, editor. Basic and clinical pharmacology. 6th ed. Oxford: Oxford, 1988.

- هاروارد:

Porter, RJ 1988, "Antiepileptic drugs", In: Katzung, BG (ed.), *Basic and clinical pharmacology*, 6th ed. Oxford, Oxford.

-

مقاله

- ونکوور:

- Russell FD, Coppell AL. Coffee drinking and cancer of the pancreas. Biochem Pharmacol 1998 mar 1;55(5):697-701.

- هاروارد:

- Russell, FD & Coppell AL 1998, "Coffee drinking and cancer of the pancreas", *Biochem Pharmacol* vol. 1, no.55(5):pp. 697-701.

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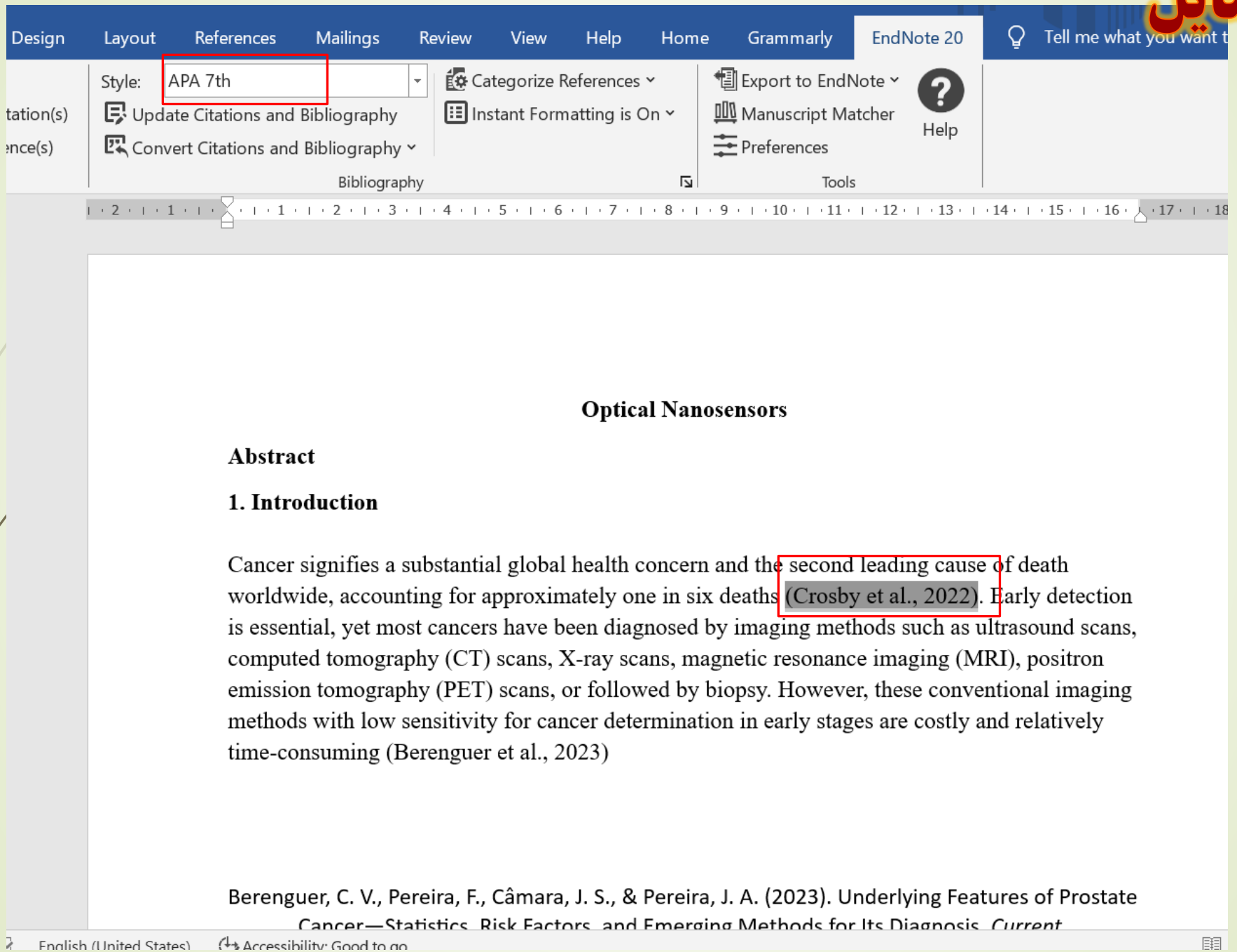

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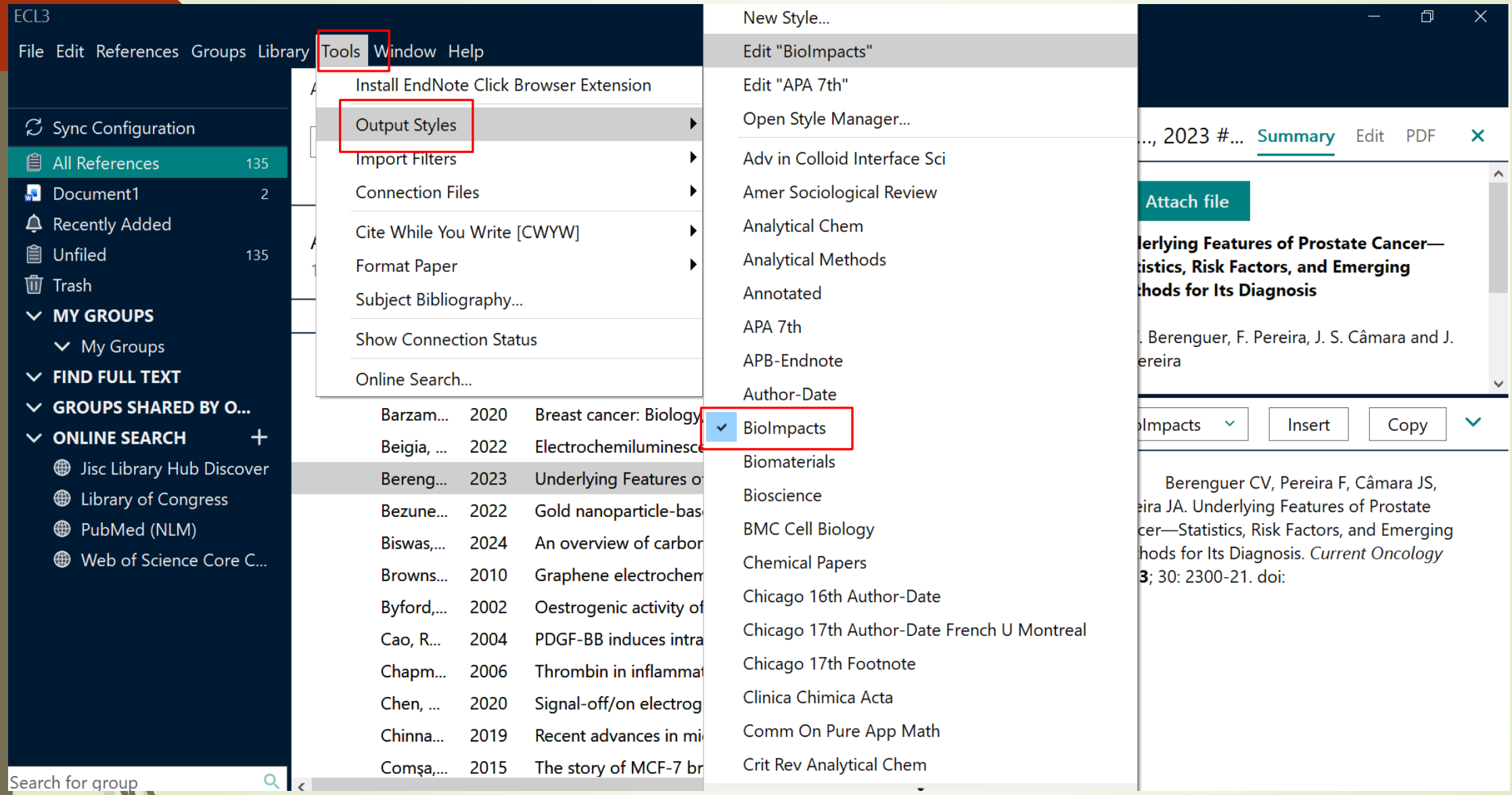

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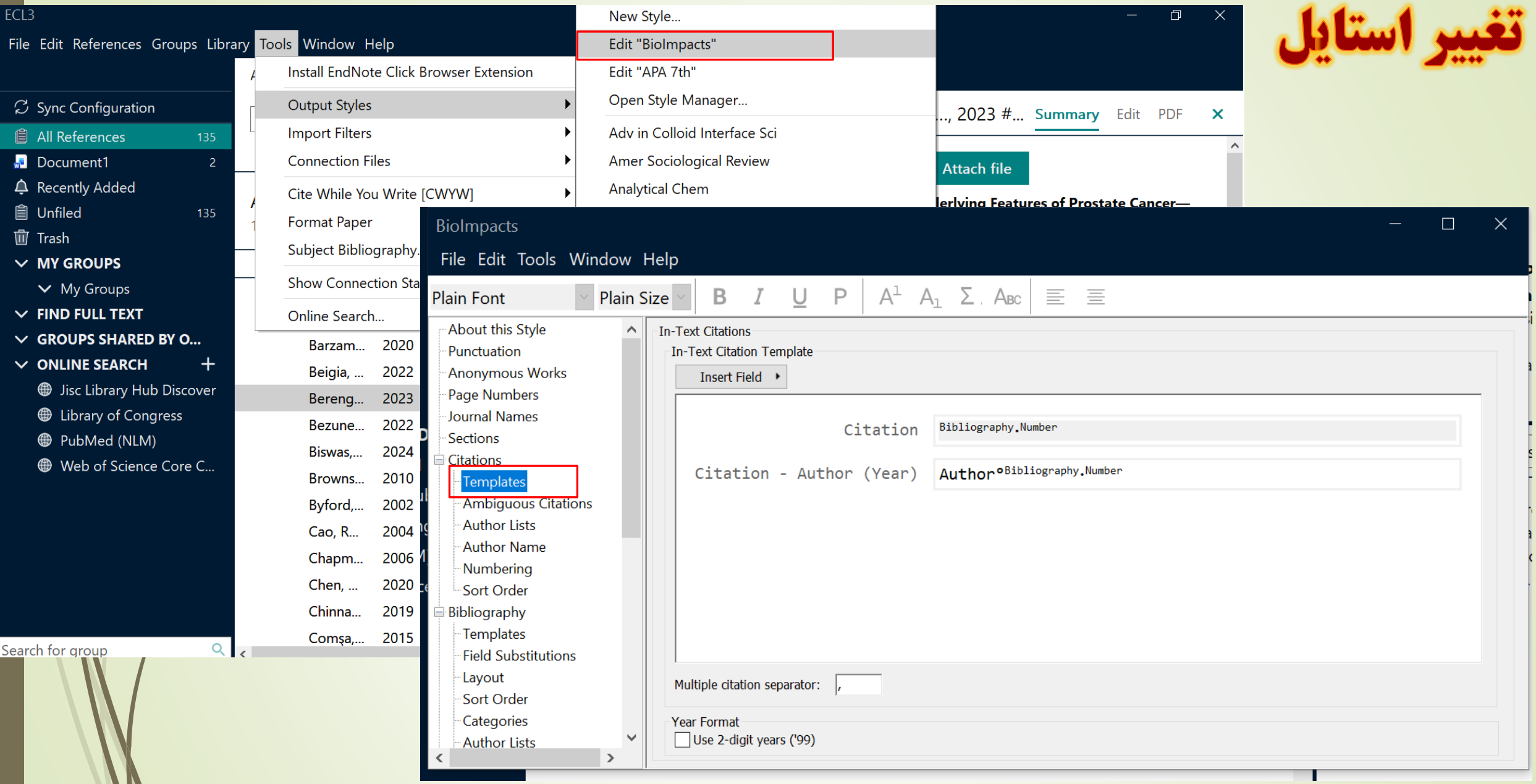

تغییر استایل

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  - Author Lists

Author Separators

Number of Authors			between	before last	before last in format: Author (Year)
1	to	100	,	,	,
100	to	100	,	,	,

Abbreviated Author List - First Appearance

- ○ List all author names
- ◉ If 3 or more authors, list the first 2 author(s)

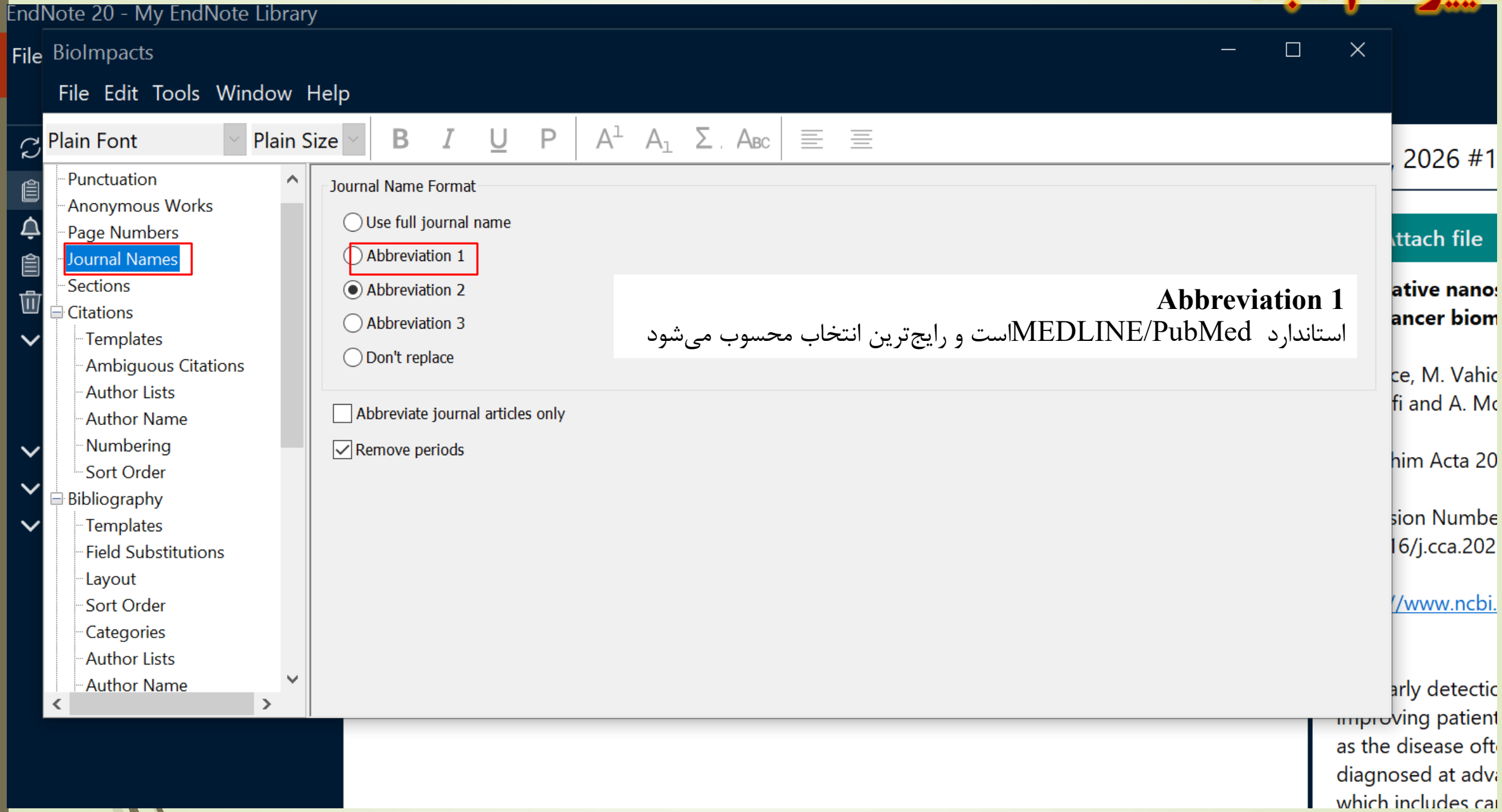
and abbreviate with: et al. ☐ Italic

Abbreviated Author List - Subsequent Appearances

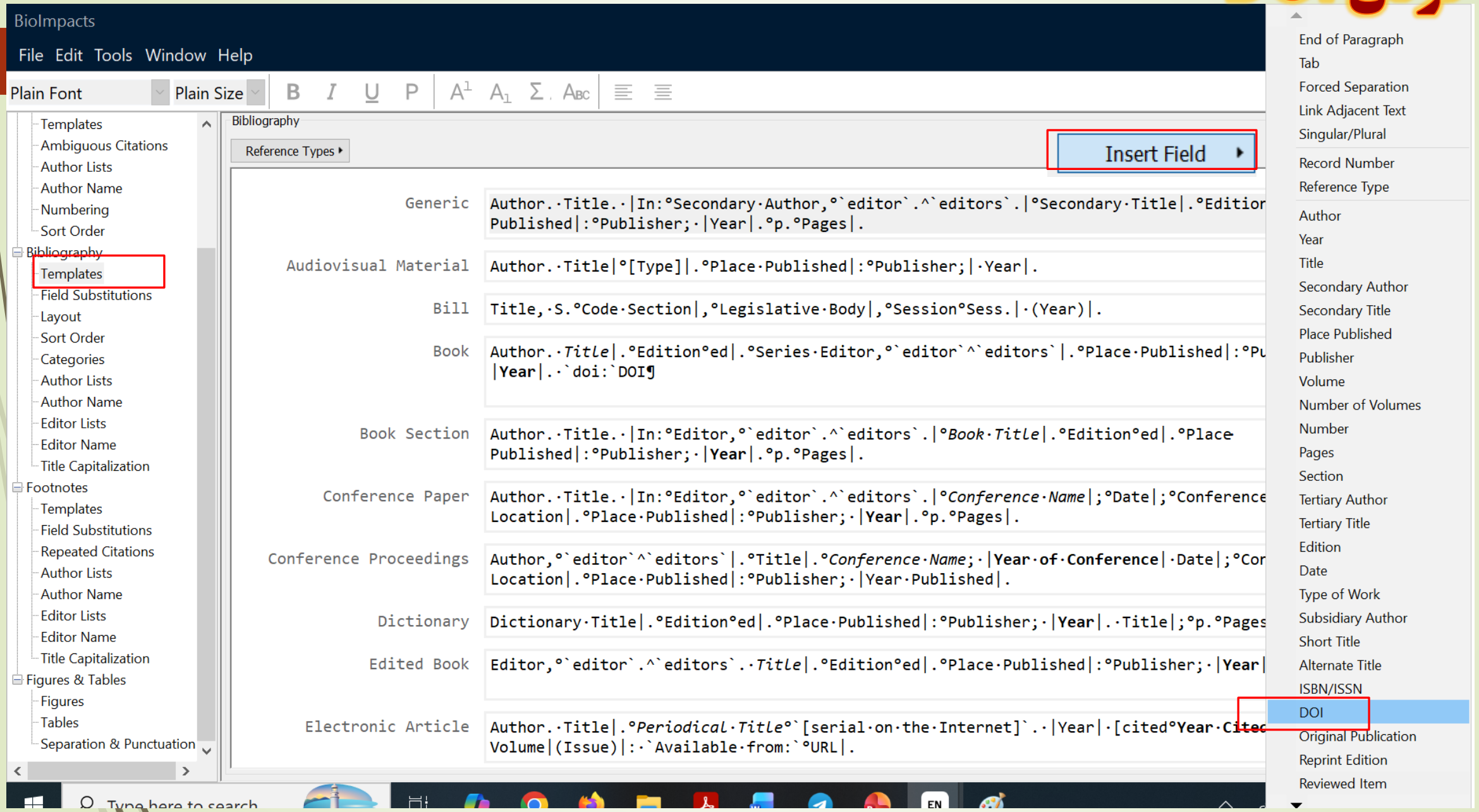
- ○ List all author names
- ◉ If 3 or more authors, list the first 2 author(s)

and abbreviate with: ☐ Italic

تغییر نام مجله



وارد کردن DOI



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