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Supporting Documents for NAAC Annual Quality Assurance Report (AQAR) Period: 2023-24

Criterion 6	**GOVERNANCE, LEADERSHIP AND MANAGEMENT**
Key Indicator 6.5	**INTERNAL QUALITY ASSURANCE SYSTEM**
Metric No. 6.5.2	**The institution reviews its teaching learning process, structures, and methodologies of operations and learning outcomes at periodic intervals through IQAC set up as per norms and recorded the incremental improvements in various activities**

Submitted to NAAC NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL

Submitted by IQAC, Sonari College, P.O. Sonari,
Dist : Charaideo, PIN : 785690 (Assam)

On the basis of the recommendations made in the 2nd cycle of NAAC accreditation, the institution has taken the following steps for its quality enhancement.

ICT facilities are substantially strengthened with:

- **Use of computer labs**
- **Use of smartboards and PowerPoint presentations in seminars/webinars etc.**
- **Use of online ICT methods like Google Classrooms, WhatsApp groups etc.**

ICT Hardware used in Teaching-Learning	Number available in the College
Portable Projectors	4
Smart Boards	8
Desktops	76
Laptops	13
LED TV	1
Printers	9
Scanners	2
Overhead Projectors	2
Photocopiers	4

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Use of ICT tools by Teachers and Students

Use of Digital Classroom in Student Centric Activity during the year 2023-24

Dept. of Zoology using Smart panels to elaborate the diagrams:

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Interdepartmental Seminar Presentation organized by Science Stream on 29th September, 2023

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Intra-department Seminar presentation by Department of Zoology on 22nd March, 2024

Student workshop organized by the department of Engilsh on 3rd Nov.,23

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Two-Days workshop on "Latex for beginners" organized by the Dept. of Mathematics from 16th to 17th October, 2023

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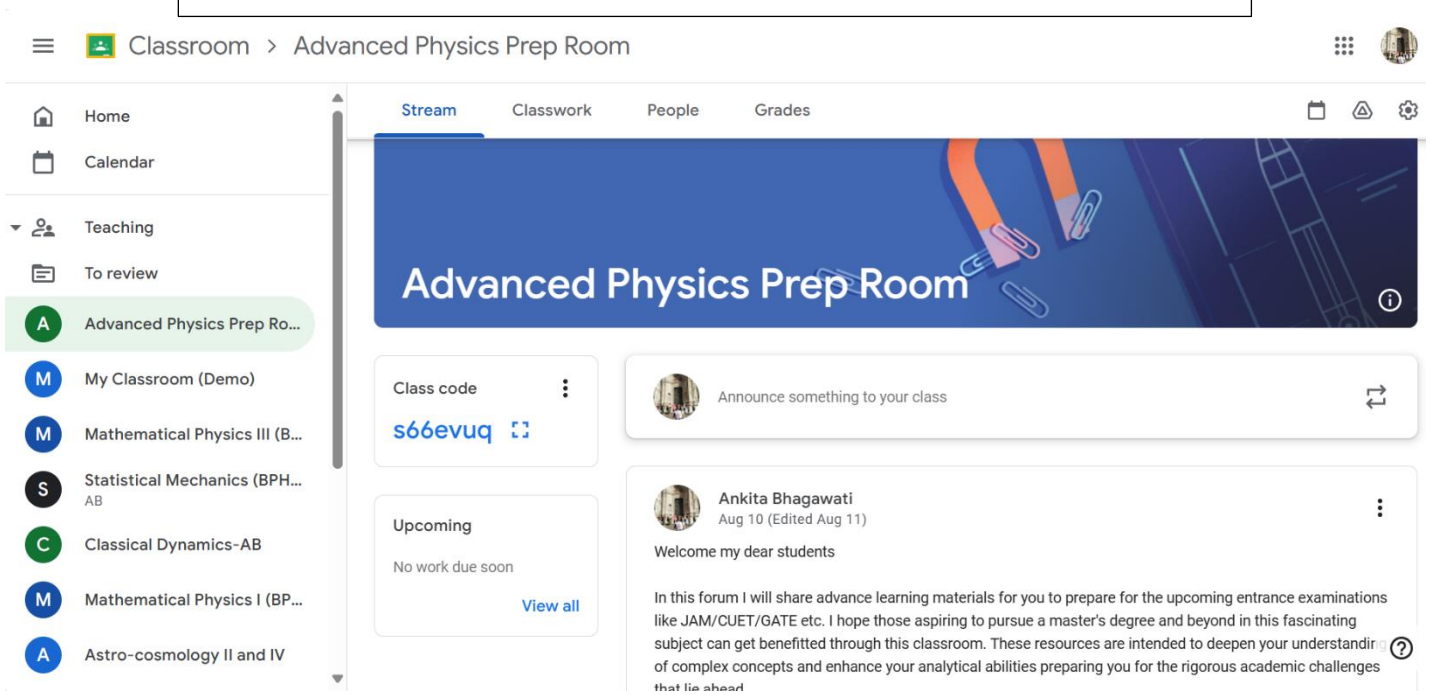
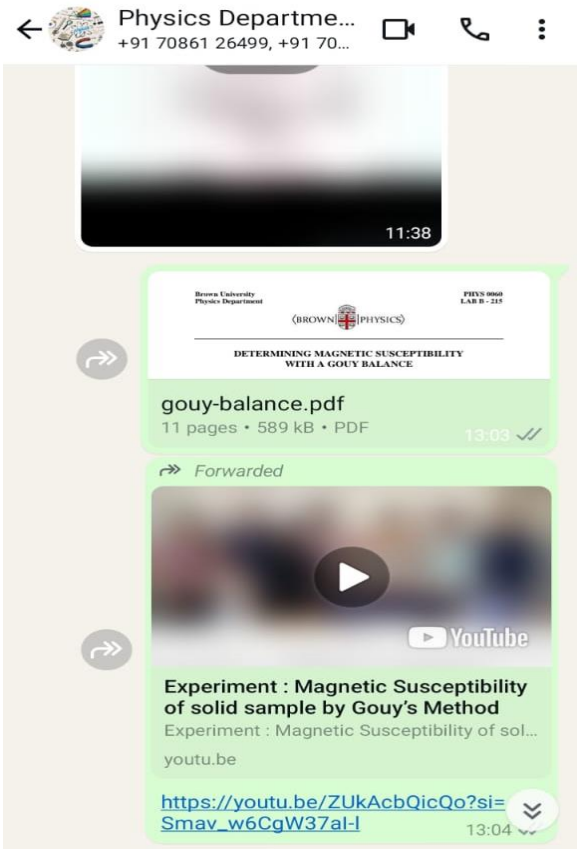
Use of online ICT tools like Google classrooms and WhatsApp groups





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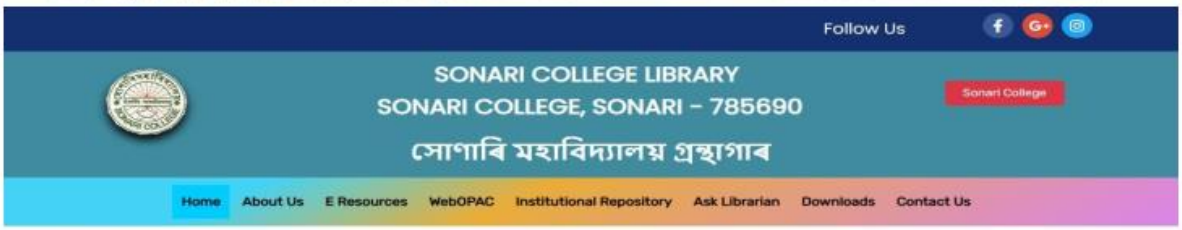
Computerization and digitalization of the library



Sonari College Library Website

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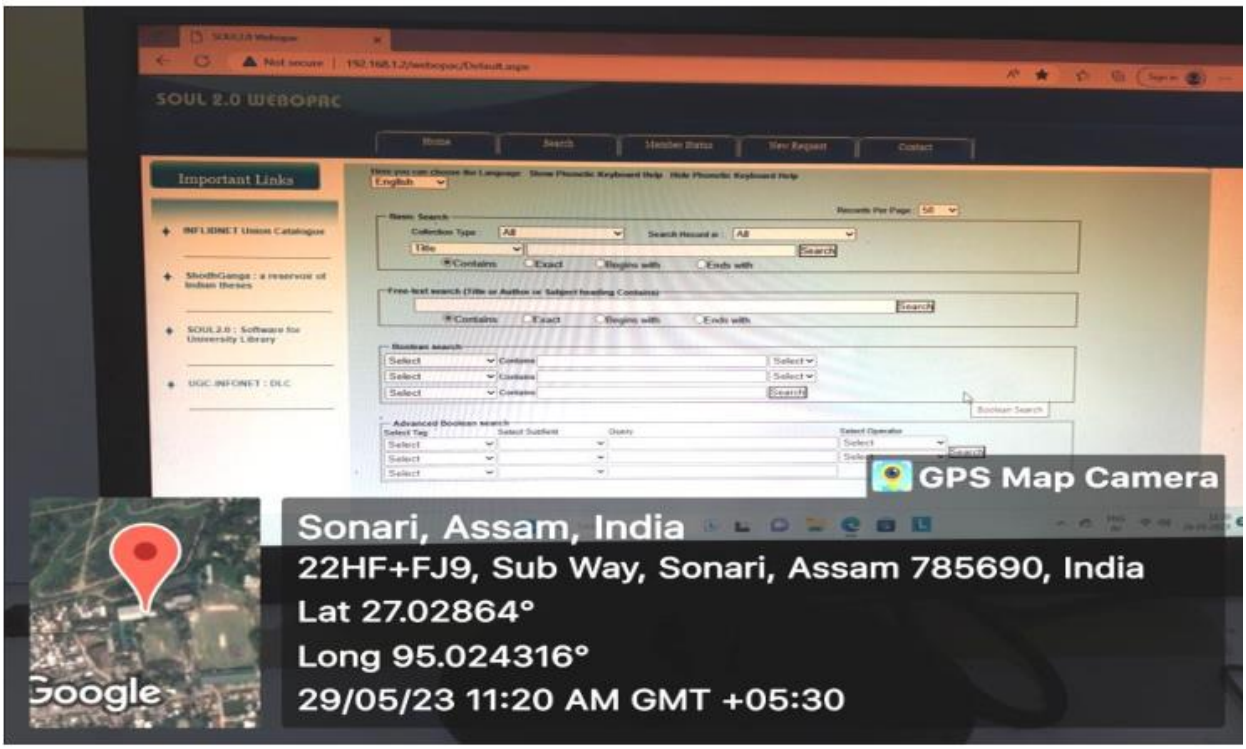

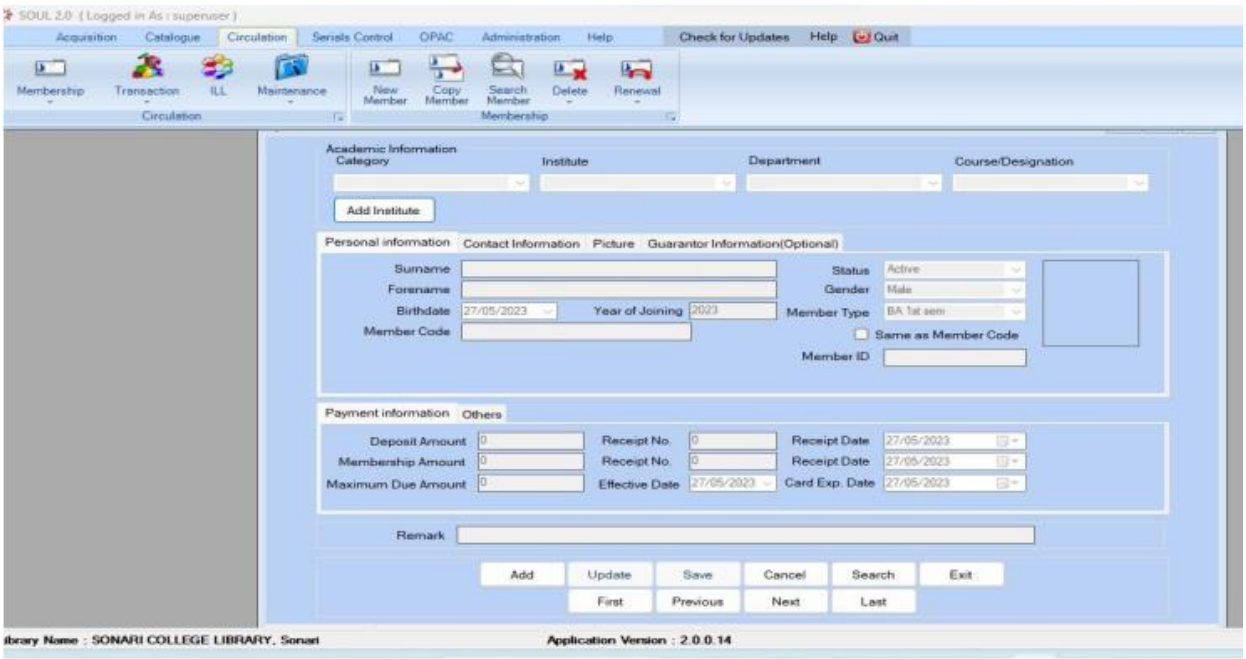

SOUL: Library Management Software

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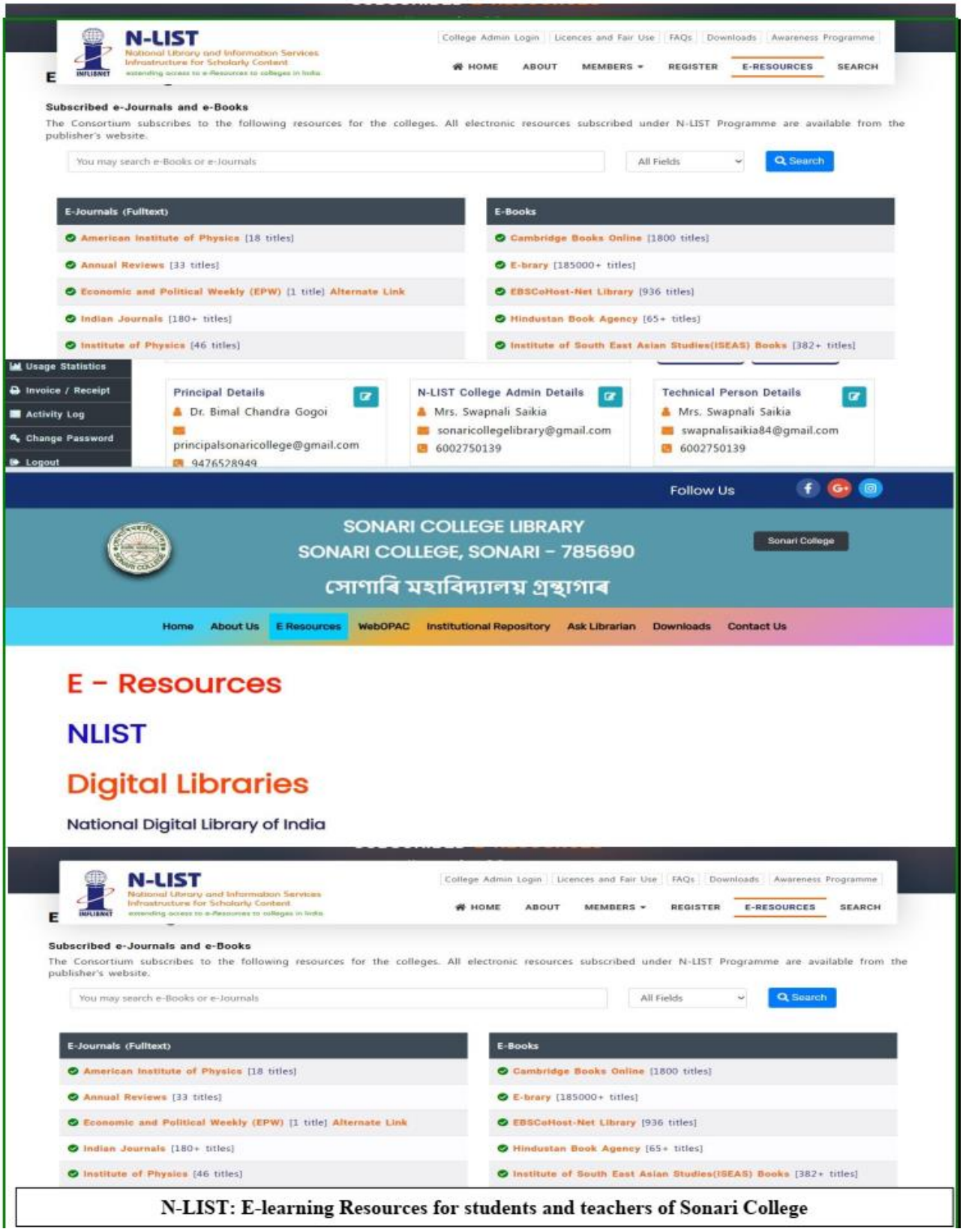

N-LIST: E-learning Resources for students and teachers of Sonari College

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Ministry of Education
Government of India

Indian Institute of Technology
Kharagpur

National Digital Library of India

CERTIFICATE OF REGISTRATION

This is to certify that "**Sonari College P.O. Sonari-785690**" is registered as a NDLI Club under the National Digital Library of India.

Registration Number: INASNC3FNEERCKY
Date Of Registration: 03/12/2022
Valid Upto: 03/12/2023

पार्थप्रतिम दास

Dr. Partha Pratim Das
Joint Principal Investigator
National Digital Library of India Project
Indian Institute of Technology
Kharagpur

NDLI CLUB PARTNER
National Digital Library of India
- LEARN. SHARE. GROW. -

NDLI CERTIFICATE

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A study on ODE-based model of risk breast cancer with body mass

Sana Abdulkream Alharbi[a], Kaushik Dehingia[b], Awatif Jahman Alqarni[c], Mona Alsulami[d], AA Al Qarni[c], Anusmita Das[e] and Evren Hinçal[e]

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ABSTRACT

In this study, we propose a fat-estrogen-breast cancer mathematical model to discuss the effect of body mass, estrogen, and the immune system on the evolution of cancer cells. To do this, stability analysis has been performed at each of the biologically feasible equilibria of the model. It is found that the tumor-free equilibrium exists if the estrogen level is normal and is asymptotically stable if the growth of tumor cells in the presence of fat cells is less than the response rate of immune cells against the tumor; otherwise, it is unstable. However, the co-existing equilibrium exists for excess estrogen levels and it is stable, provided certain conditions hold. It is observed that the eradication or proliferation of tumor cells directly depends on the growth of fat cells, the response of the immune system against the tumor, and the estrogen level. Numerical simulations have been performed to verify the theoretical results.

ARTICLE HISTORY
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KEYWORDS
Mathematical modeling; breast cancer; estrogen; stability; numerical simulation

2020 AMS SUBJECT CLASSIFICATIONS
37M05; 37M10; 37N25; 92B05

1. Introduction

Obesity and excess weight are common health conditions affecting more than 600 million people worldwide. It is characterized when the body mass index (BMI) is more than 30 kg/m^2, caused mainly by a sedentary lifestyle and over-nutrition [1]. Over one-third of adults in the US are obese, which is becoming a critical health condition. According to the study [2], the prevalence of obesity was 27.6% in Saudi Arabia. Moreover, obesity could lead to other severe conditions, including hypertension, diabetes mellitus, heart problems, and cancer. Several studies have discussed the effect of adiposity on diabetes and coronary illness, but little is known about its impact on cancer, especially breast cancer [3–5].

The most common cause of death for women in emerging nations is breast cancer [6]. Breast cancer is possibly the most prevalent malignant growth and the most frequent obstructive medical condition in females, with 1.67 million women diagnosed in 2012

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European Chemical Societies Publishing

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Hot Paper

Chemo- and Regioselective Catalytic Cross-Coupling Reaction of Ketones for the Synthesis of β, γ-Disubstituted β, γ-Unsaturated Ketones

Priyanka Adhikari,[a] Dipanjan Bhattacharyya,[a] Kritartha Deori,[a] Bikash Kumar Sarmah,[a, b] and Animesh Das*[a]

C–C bond forming reaction of ketone with aldehyde is well-studied for the synthesis of α, β-unsaturated ketones, however, the reaction with two different ketones to unsaturated carbonyl compound has not yet been systematically studied. Probably due to the relatively low reactivity of ketones as electrophiles (aldol acceptors), its propensity for retro-aldol reaction. The reactions often suffer from unsatisfactory chemoselectivity (self- vs. crossed aldol products) and regioselectivity (thermodynamic *vs.* kinetic enolate). In this quest, we report here for the first time selective cross-coupling reaction of ketones to β-branched β, γ-unsaturated ketones by using ruthenium catalysis. Interestingly, single crossed aldol condensation products are formed even in reactions where a mixture of products is possible. Reaction is highly chemoselective, regioselective and produces H_2O as the only byproducts making the protocol environmentally benign. Method is compatible with a wide variety of sensitive functional group and applicable for even problematic aliphatic ketones as substrates. Notably, acetone was found as a three-carbon feedstock for the syntheses of simple β, γ-unsaturated ketone compounds. The process can further be extended to the gram-scale reaction and late-stage functionalization of natural products. With the help of DFT calculations, several control experiments, and deuterium-labeling experiments, the mechanistic finding demonstrated that initial aldol-condensation of ketones to a β, β-disubstituted α, β-unsaturated ketone, which further isomerizes to a β, γ- unsaturated ketone *via* η^3-allyl ruthenium complex.

Introduction

β,γ-unsaturated ketone compounds represent important structural motifs that is frequently found in numerous bioactive molecules and natural products.[1] These high-value synthons are also extensively used as building blocks in a number of total syntheses by manipulating their carbonyl and alkene moieties.[2] In addition, β-branched unsaturated ketones are found as key intermediates in the catalytic cross-coupling of secondary alcohols and the α-alkylation of ketones with secondary alcohols using well-defined Ru–MACHO complex,[3] and these unsaturated ketone are also applied in photochemical reactions.[4] Owing to ist great demand, synthesis of these β, γ-unsaturated ketones attracts potential attention in chemical research. Route for the synthesis of β,γ-unsaturated ketone remains at an early stage of development compared with the related α,β-unsaturated ketones.[5] Earlier research included by the conversion of unsaturated esters to corresponding ketones *via* Weinreb amides using organolithium reagent or Grignard reagent.[6] Nevertheless, precedents are low atom economy, limited substrate scope, and require several reaction steps for the synthesis of the starting materials. Moreover, the reactivity of the organometallic reagent must be taken into account during synthetic transformation since these are reactive and incompatible with many functional groups. A second strategy is the use of transition-metal catalyzed cross-coupling reaction of ketones (or enolates) with alkenylbromides, alkenyltriflates or alkenyl tosylates.[7] Further, ruthenium hydride-catalyzed cross-coupling reaction of aldehydes with dienes[8] or alkynes[9] were employed to enrich this chemistry. In the vast majority of cases, reaction was directed with a prefunctionalized starting material, which limits the applications of the methods to relatively simple targets. In some case method also suffer from low β,γ regioselectivity.[10]

In this quest, cross-aldol condensation of ketones may offer a straightforward and boosting approach to access this class of β-branched β, γ-unsaturated ketones *via* alkene isomerization (Scheme 1). Since the starting material ketones is easily available and inexpensive, this may provide broad substrate scopes. Aldol condensation of ketone with aldehyde is well-explored,[11] however, reaction of two different ketones to unsaturated carbonyl compound has not yet been systematically studied.[12] Probably due to the relatively low reactivity of ketones as electrophiles (aldol acceptors), its propensity for retro-aldol reaction. The reactions often suffer from unsatisfactory chemoselectivity (self- vs. crossed aldol, alkene products) and regioselectivity (thermodynamic *vs.* kinetic enolate).[11c]

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PAPER

100 MeV protons from nanostructured hemispherical target using PIC simulations

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Keywords: nano-structured targets, laser plasma interaction, ion acceleration, particle in cell simulation, hemispherical target, ambipolar expansion

Abstract

The improvement of laser-driven proton energy with the use of nano-structured hemispherical targets of 100 nm thickness over conventional flat foil has been reported in this work. The curvature of the target is found to result in focussed particle density at the center of the hemispherical target followed by emergence of energetic ions due to combined action of sheath electric field and ambipolar expansion. The presence of nano-rods on the curved hemispherical target further increases the laser energy absorption by the electrons, thus resulting in increase in the maximum proton energy. Use of hemispherical target embedded with nanorods is possibly reported here for the first time that may generate protons with energy 92 MeV by using linearly polarised laser of intensity 10^{21} W cm^{-2} and pulse duration of 30 fs. At this laser intensity, the energy gain by the protons is much higher compared to the conventional flat foil targets. The maximum proton energy can be increased further to 103 MeV by using truncated hemispherical target of similar parameter.

1. Introduction

The ongoing development of high-power, ultra-short laser facilities has paved the way for numerous applications over the past few decades [1–5]. Laser driven acceleration of electrons and ions is one of such areas, which has received a lot of attention because of its cost effective and compact nature in comparison to the conventional accelerators. The localised nature of laser energy makes it possible for the electrons to get accelerated to MeVs of energy within micro-meter long distance owing to its strong accelerating field, to attain which, the conventional accelerators require km long beamlines.

Applications in medical fields, nuclear physics research, material science studies, etc require the accelerated charged particles to have certain characteristics like high energy, low divergence, mono-energetic nature, stability, repeatability, etc. To attain these, researchers work with various types of targets and irradiate them with different kinds of laser pulses. Based on the target and laser parameters, different electron and ion acceleration regimes come into play. Strategically capitalising the different ion acceleration mechanisms makes it feasible to optimise and tailor the desired characteristics of the accelerated ions, making it applicable for practical purposes.

The interaction of intense laser pulse with micron-thick foil targets has been explored experimentally and protons with energy of multi MeVs were first reported in the year 2000 [6–8]. Since then, with the improvement in laser technology and the increase in energy of the laser pulse, the energy of accelerated protons has increased manifold experimentally. The understanding of laser energy absorption and acceleration of the electrons and ions has developed with the development of basic mechanisms of electrons and ion acceleration and is continuing [9–11].

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Physica Scripta

PAPER

A study on the dynamics of a breast cancer model with discrete-time delay

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Keywords: breast cancer, stability, Hopf bifurcation, numerical simulation

Abstract

This study aims to discuss the impact of discrete-time delay on the anti-tumor immune response against tumor growth, excess levels of estrogen, and the source rate of immune cells in a breast cancer model. The non-negativity and boundedness of the solutions of the model are discussed. The existence of equilibria and their stability are examined. It is found that if the estrogen level is normal and the source rate of immune cells is low, the stability of the model around the co-existing equilibrium switches to instability via a Hopf bifurcation as the time delay increases. To validate the theoretical findings, a few numerical examples have been presented. The main result of this study is that the growth of tumors can be controlled if the immune system quickly generates an anti-tumor immune response. However, if the immune system takes a longer time to generate anti-tumor immune responses, the tumor growth cannot be controlled, and the system becomes unstable, which may result in the further spread of the disease.

1. Introduction

Breast cancer is the most prominent cancer among women, and every year, it affects millions of women worldwide [1]. A breast is made up of lobules, ducts, and connective tissue. However, breast cancer can originate from any part of the breast due to DNA damage in the breast, and breast cells can start to grow and divide uncontrollably. To better comprehend the onset and progression of breast cancer, lots of mathematical oncology researchers are increasingly turning their attention to breast cancer modelling [2–4].

Breast cancer modelling involves using mathematical and statistical models to describe the growth and spread of cancer cells within the breast and throughout the body. Many mathematical works have been performed to capture some key features of the dynamics of breast cancer cells [5, 6]. However, there are still many challenges, such as the complex interactions between cancer cells and the immune system and cancer's genetic and molecular characteristics, to be addressed in breast cancer modelling [7, 8]. Enderling *et al* [9] analyzed a breast cancer model to comprehend its development and the impact of various cancer-curing treatment modalities, identify different sources of local recurrence, and examine their prevention. In [10], it is reported that estrogen levels play a key role in the control of breast cancer. The role of estrogen on breast cancer dynamics is examined in [11], which suggests that too much estrogen raises the risk of breast cancer. The interplay between immune macrophages and breast cancer cells has been observed in [12]. Jarrett *et al* [13] investigated the immune system's efficacy and trastuzumab therapy on breast cancer. An optimally administered drug in terms of chemotherapy and the ketogenic diet is designed in [14] to minimize the cancerous breast cells. Perez *et al* [15] reported that fractional derivatives can change the dynamics of breast cancer and can give a clear picture of its dynamics. The combined effect of AZD9496 therapy and palbociclib

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Research article

Within-host delay differential model for SARS-CoV-2 kinetics with saturated antiviral responses

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Abstract: The present study discussed a model to describe the SARS-CoV-2 viral kinetics in the presence of saturated antiviral responses. A discrete-time delay was introduced due to the time required for uninfected epithelial cells to activate a suitable antiviral response by generating immune cytokines and chemokines. We examined the system's stability at each equilibrium point. A threshold value was obtained for which the system switched from stability to instability via a Hopf bifurcation. The length of the time delay has been computed, for which the system has preserved its stability. Numerical results show that the system was stable for the faster antiviral responses of epithelial cells to the virus concentration, i.e., quick antiviral responses stabilized patients' bodies by neutralizing the virus. However, if the antiviral response of epithelial cells to the virus increased, the system became unstable, and the virus occupied the whole body, which caused patients' deaths.

Keywords: mathematical modeling; SARS-CoV-2; time delay; stability; Hopf bifurcation; numerical simulations

1. Introduction

Since January 2020, a deadly pandemic known as COVID-19 has spread from person to person, wreaking havoc across the globe. The virus responsible for the illness is SARS-CoV-2, also known as the 2019-ncov [1]. Multiple cases of pneumonia, dry cough, fever, fatigue, breathing difficulty and bilateral lung infiltration have been reported due to the virus's spread within the human body [2,3]. According to the World Health Organization (WHO), as of March 18, 2023 there have been 760