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Application of Biological Mathematics in Medical Science

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ABSTRACT

Mathematics plays a role in many disciplines of science, primarily as a mathematical modelling tool. In this paper, we study the role played by mathematics in medical science and analysis that the real-life application of calculus, especially in the medical field. This is important because calculus can be used to solve and analyse real-life problems, but also to make medical procedures more efficient and beneficial to the public.
Applications of mathematics in medical science using calculus can be used not only in drug sensitivity. Also, the Right dosage of medicines produces the desired effect but to minimizes the negative side effects.

KEYWORDS

Mathematics, Biological, Calculus, Mathematical models, Bio-mathematics, mathematically modeling.

INTRODUCTION

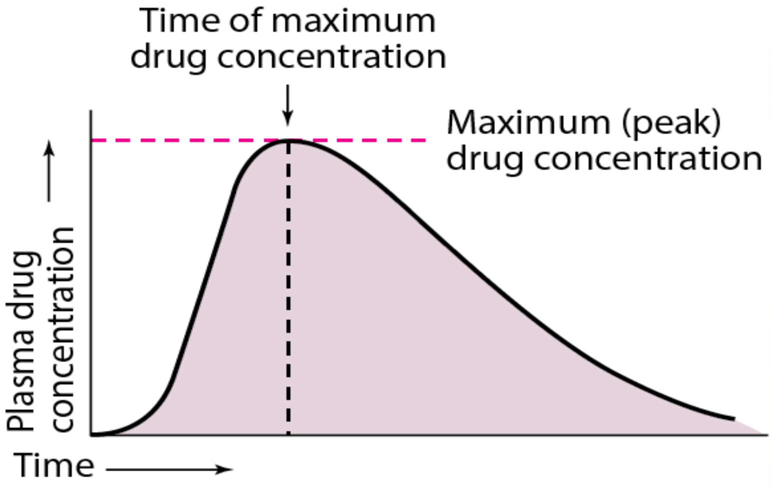
Mathematics for biosciences helps us to understand many biological and medical phenomena from those topics such as population growth, biology oscillations, pattern formation, and the spread of disease, human physiology, systems and organs, the development of tumour's, etc. It also produces new mathematical questions.
The use of mathematics in biology for the raw data mass is in tracking change over time. Bio-statistics uses statistical analyses to form biological phenomena such as drawing balancing or connections between biological-Variables.One of the applications of mathematics in biomedical is the use of probability and statistics, invalidating the effectiveness of drugs. Along with this mathematical field in medicine is to evaluate the survival rate of cancer patients under the treatments.

THE ROLE OF MATHEMATICS IN BIOLOGY FIELDS.

Mathematical in biological or bio-mathematics is a fast-growing and the most modern application of mathematics. Mathematics is a need in the medical profession.The aim of the new discipline has mathematics to represent modelling of biological problems to use a variety of mathematical thesis and methods. The pharmaceutical mathematics curriculum includes measurements and calculations required to impose and allot medication.
This new discipline has applications in biological, biomedical, and biotechnology. Mathematical biology has both theatrical and practical applications in research on bio, biomedical and biotechnology fields.

Biological scientists need mathematical models

Mathematical and computational models are increasingly used to help clarify bio-medical data produced by high-throughput genome and proteome projects.
Mathematical models are tools that we can use to describe the past accomplished and forecast the future performance of biotechnological processes. Bio -mathematical models can affect the tools in both fundamental research and applied research fields and development.



In this graph x-axis showing a change in time.

And the y-axis showing plasma drug concentration.

The *graph* above representing a solution to the differential equation.

Article and analysis of *how calculus* impacts the *medical research field.*

METHODOLOGY

Calculus is a branch of mathematics that is applied to real-life problems. Calculus is a mathematical study of continuous change, and it can be broken down into two types:

Differential and Integral calculus. calculus can be used in fields such as engineering, economics, and medicines.

The purpose of this presentation is to explain the real-life application of calculus, especially in the medical field. Calculus has many vital applications in medicine when considering drug dosages, blood flow, and tumour growth. This is important because calculus can be used not to solve and analyse real-life problems, but also to make medical procedures more efficient and beneficial to the public.

Calculus is often used in medicine to determine the right dosage of a drug to be administered to a patient. This is very important when taking into consideration drug sensitivity, rate of dissolution, and blood pressure.

Calculus can be applied to drug sensitivity

The concept of derivatives can be applied to determine the patient's sensitivity to a specific drug, to prevent too much of that drug from being administered. for example, if a drug's potency is given by P(t) where t is a dosage, the derivative P'(t) given the sensitivity of the body with respect to t. P'(t) gives the sensitivity of the body with respect to t. P'(t) also represents the change in P as a result of the change in the dosage of the drug.

Another topic covered in calculus that can be applied to medicines is optimization. Doctors have to prescribe the right dosage of medicines to not only produce the desired effect but also to minimize negative side effects. In order to do this, optimization is used to determine the correct dosage to produce the best result in each patient.

Exponential Growth/Decay

This calculus topic can be used in the medical field to analyze the growth of bacteria in a patient, so that doctors may combat the bacteria with antibiotics.
A patient has been exposed to bacteria in her workplace. Her lab results showed 350 bacteria in her bloodstream at time t=2 hours and 780 bacteria at time t=4 hours. Find the rate at which the bacteria multiplied. How many bacteria were present initially? Set up an equation that shows the exponential growth of this bacteria and use it to find how many bacteria were present at time t=24 hours.

Exponential Growth Formula: $y = Ce^{kt}$
C = Initial Value
K = Rate of growth/decay
T = Time
Rate of Exponential Growth
$350 = Ce^{2k}$ $780 = Ce^{4k}$
$C = 350/e^{2k}$, $C = 780/e^{4k}$
$350e^{4k} = 780e^{2k}$
$E^{4k} = 2.229e^{2k.}$
$\text{In}e^{4k} = \text{In}2.229e^{2k}$
$4k = \text{In}2.229 + 2k$
$2k = \text{In}2.229$
K = 0.4008.
The rate of exponential growth is 0.4008 bacteria per hour.
Bacteria present initially

$C = 350/ e^{2(0.4008)}$

C = 157.021

There were 157.021 bacteria present initially.

Exponential growth equation

$Y = 157.021e^{0.4008t}$ ------ Equation of exponential growth

$Y = 157.021e^{0.4008\ (24)}$

Y = 2,363,323.749 --------There is 2,363,323.749 bacteria present at time t =24 hours.

CONCLUSION

- Calculus has many real-world applications in a variety of fields.
- Calculus also holds significant importance in the medical field, especially when analysing problems.
- The use of calculus is to solve a problem and make medical procedures more efficient.

This research project work impacted my perception of how calculus is important to the medical field. Before my research,
I thought calculus was only crucial for a job in engineering and architecture.
To my surprise, calculus involved almost every aspect of medicine. It realized me grateful that school push for students to take calculus when they plan on working in the medical field instead of just allowing them to take the basics and not have a deeper understanding of the field they plan.

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