Escuela Profesional de
Ciencia de la Computación

Bioinformatics

Introduction to Bioinformatics

MSc. Vicente Machaca Arceda

Universidad Nacional de San Agustín de Arequipa

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Overview

vmachacaa@unsa.edu.pe

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- Understand what is Bioinformatics, Computer Biology and Computation Molecular Biology.

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Objectives

- Understand what is Bioinformatics, Computer Biology and Computation Molecular Biology.
- Learn the areas of research in Bioinformatics.

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Motivation

What microorganism live in our armpits or in our mouths?

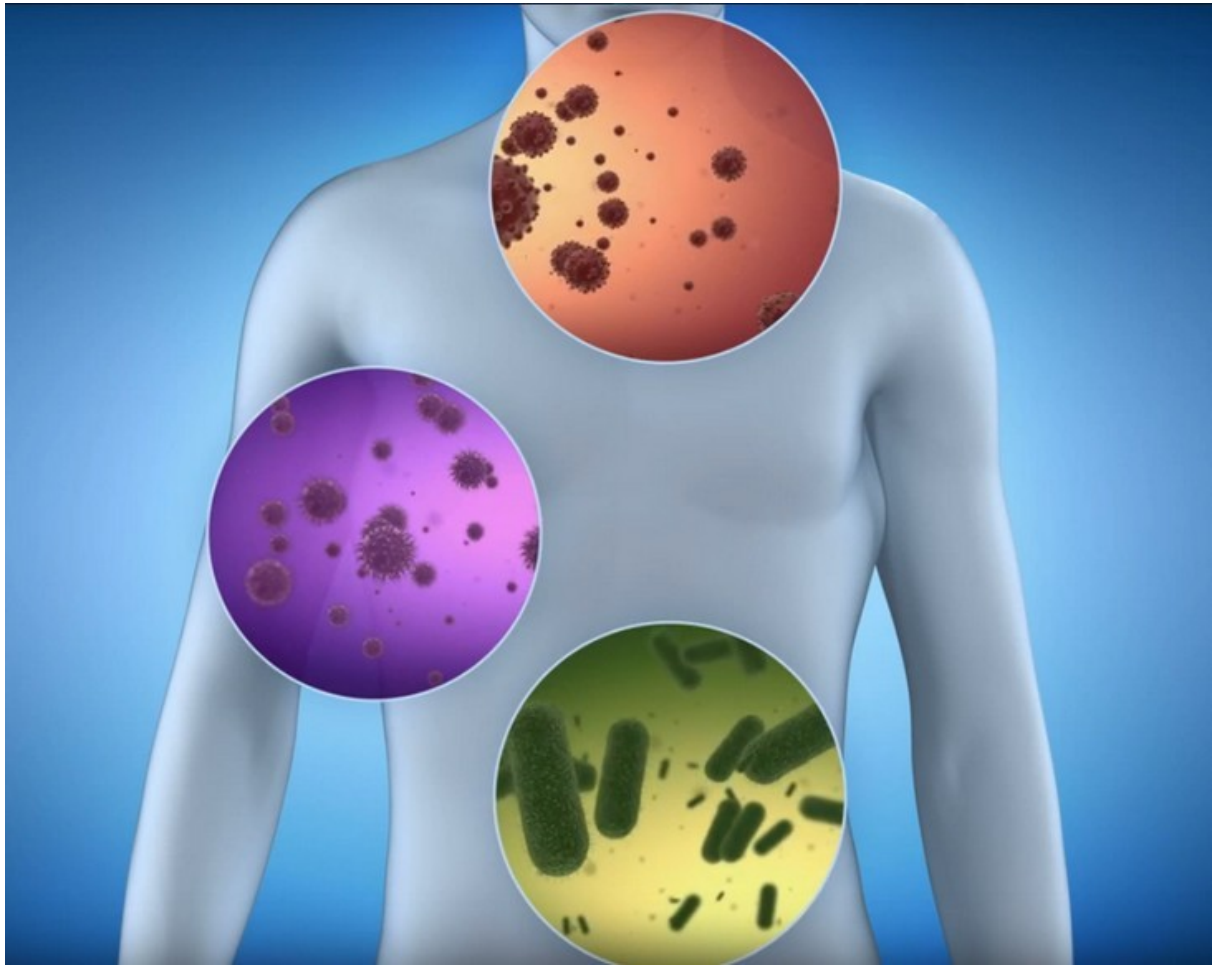

Figure: What microorganism live in our armpits or in our mouths?

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Motivation

Is there a kindness gene?

Figure: Is there a kindness gene?

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Motivation

Why a person has cancer?

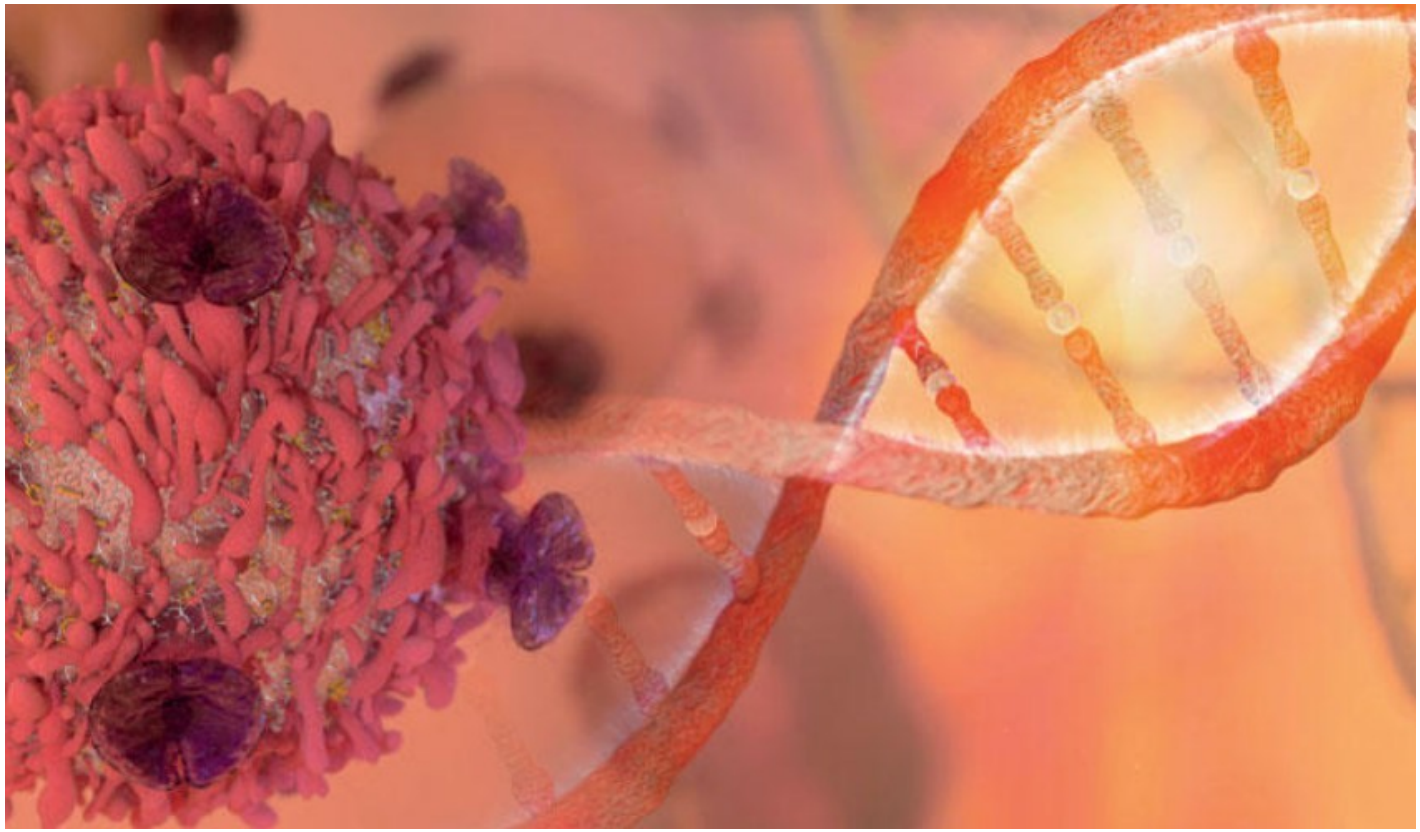

Figure: Why a person has cancer?

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Motivation

Why some medicines no work in some persons?

Figure: Why some medicines no work in some persons?

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Motivation

Treatment Development

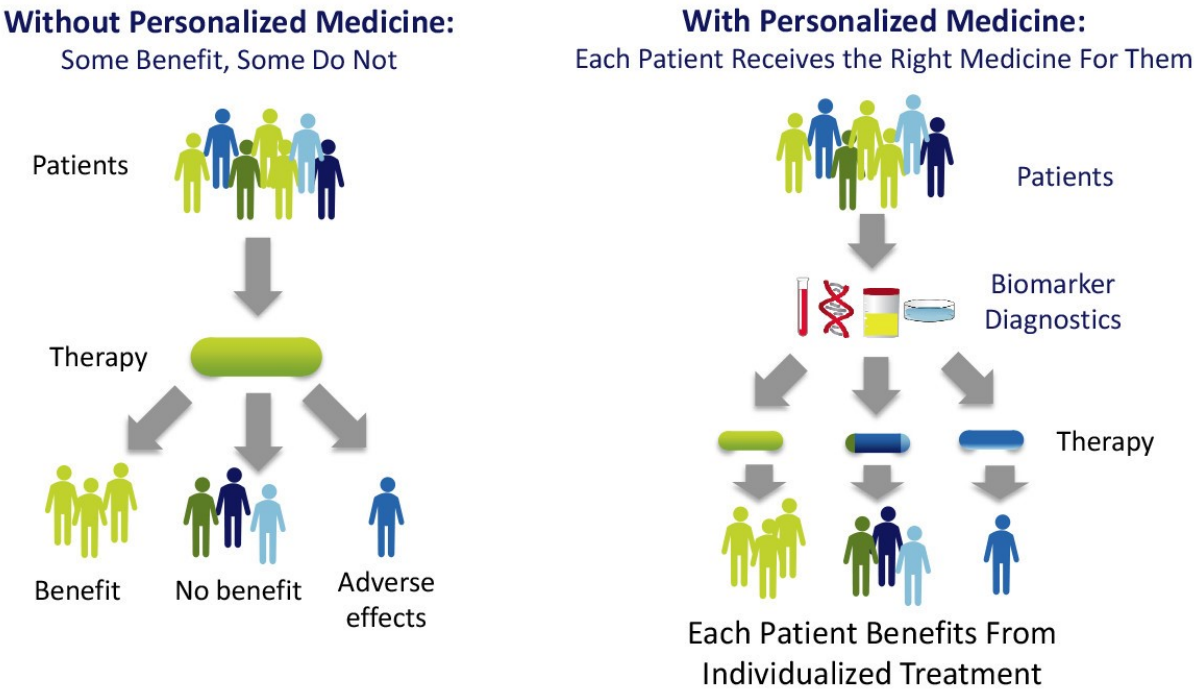

Figure: Personalized Medicine: New Approach to Treatment of Disease

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Introduction

What is Bioinformatics?

According to Luscombe et al.: **Bioinformatics** involves the technology that uses computers for storage, retrieval, manipulation, and distribution of information related to biological macromolecules such as DNA, RNA, and proteins [1].

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Introduction

Bioinformatics vs Computational Biology

Bioinformatics is limited to sequence, structural, and functional analysis of genes and genomes and their corresponding products and is often considered **Computational molecular biology**. However, **Computational Biology** encompasses all biological areas that involve computation [2].

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Introduction

Genomics

Genomics is the study of whole genomes of organisms. Genomics uses a combination of recombinant DNA, DNA sequencing methods, and bioinformatics to sequence, assemble, and analyse the structure and function of genomes. It differs from classical **Genetics** in that it study genes and their heredity meanwhile Genomics study the whole genome [3].

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Motivation

Areas Bioinformaics can help with

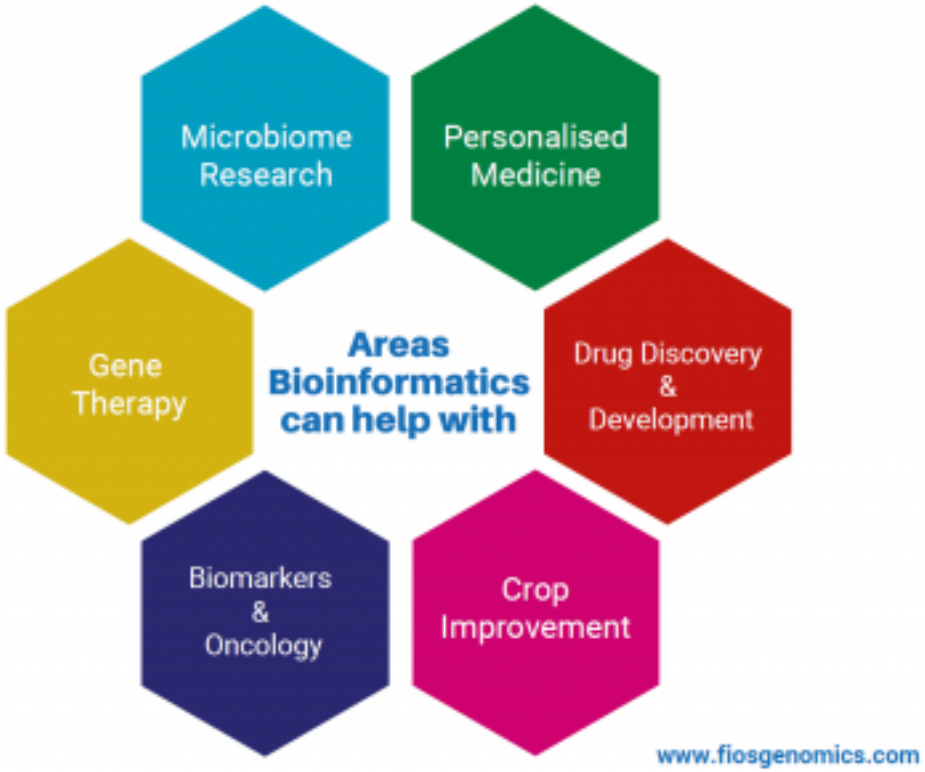

Figure: Areas Bioinformaics can help with.

Microbiome
study the genetic material of microbes, bacteria, fungi, etc.

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Motivation

Areas Bioinformaics can help with

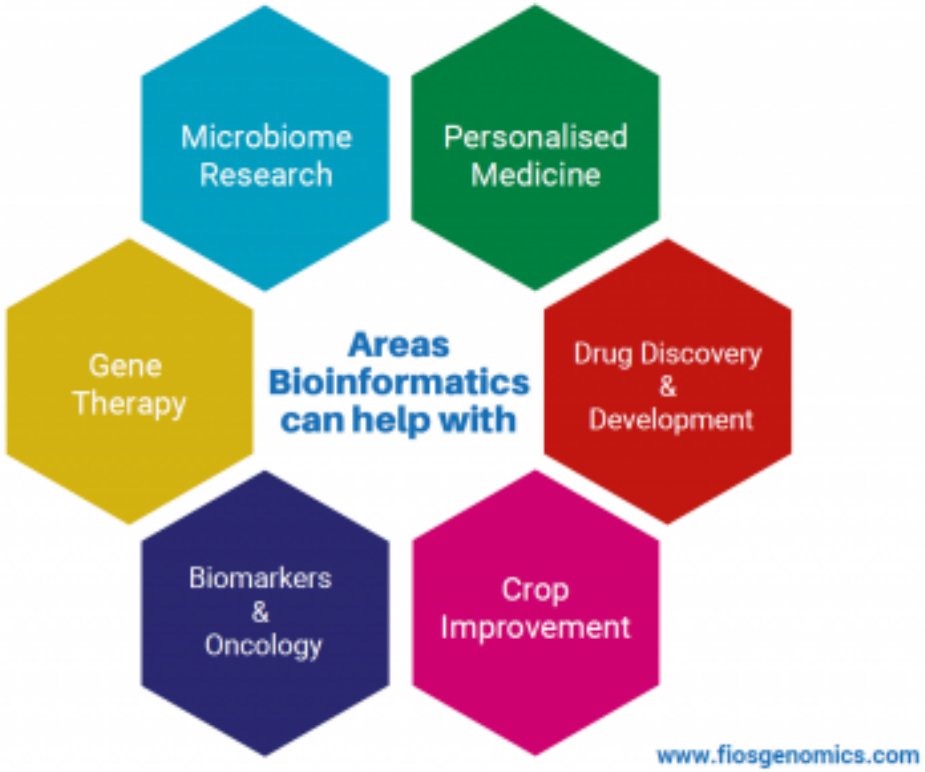

Figure: Areas Bioinformaics can help with.

Personalized medicine has the potential to tailor therapy with the best response and highest safety margin to ensure better patient care.

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Motivation

Areas Bioinformaics can help with

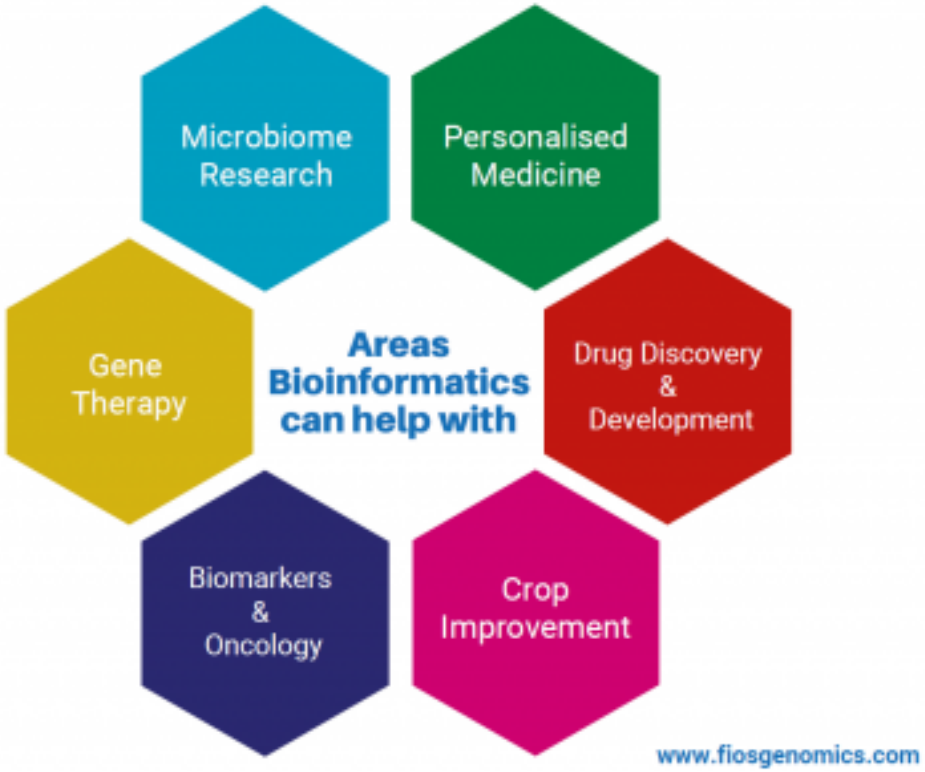

Figure: Areas Bioinformaics can help with.

Drug descovery is the process through which potential new medicines are identified.

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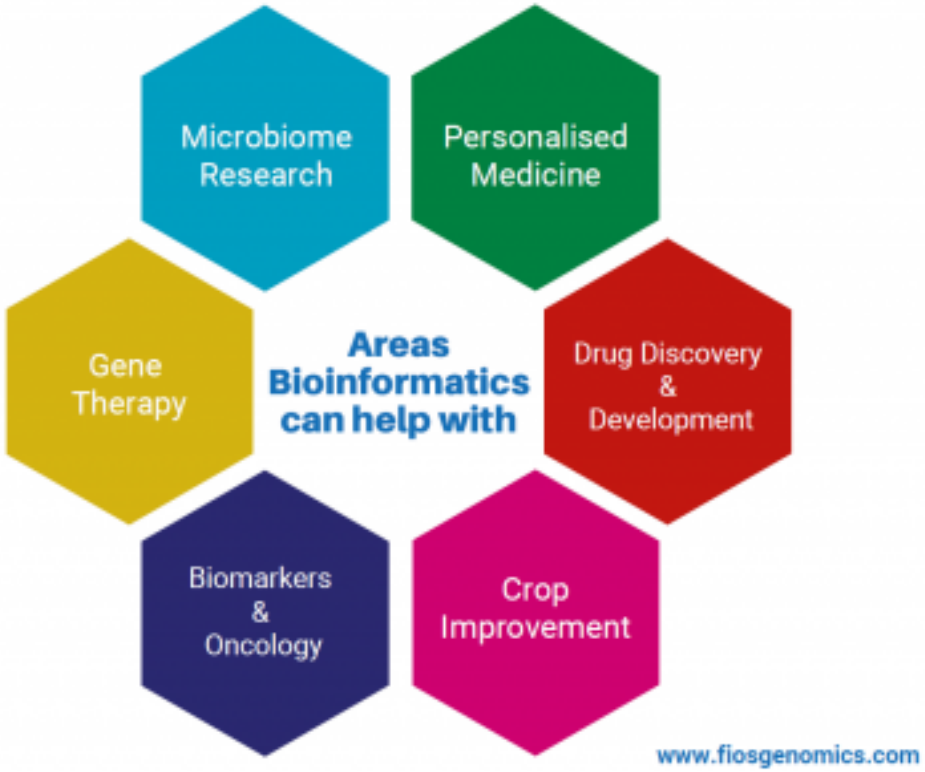

Figure: Areas Bioinformaics can help with.

Crop improvement help to produce stronger, more drought, disease and insect resistant crops.

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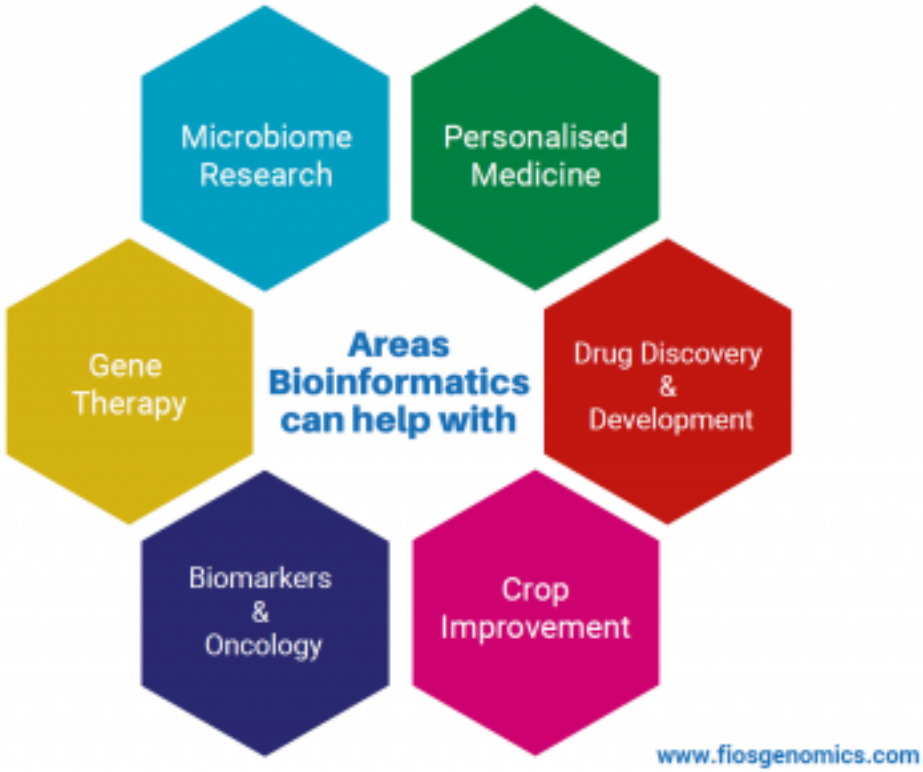

Figure: Areas Bioinformaics can help with.

Biomarkers & oncology could be used as screening/early detection tool of cancer diagnostic and prognostic.

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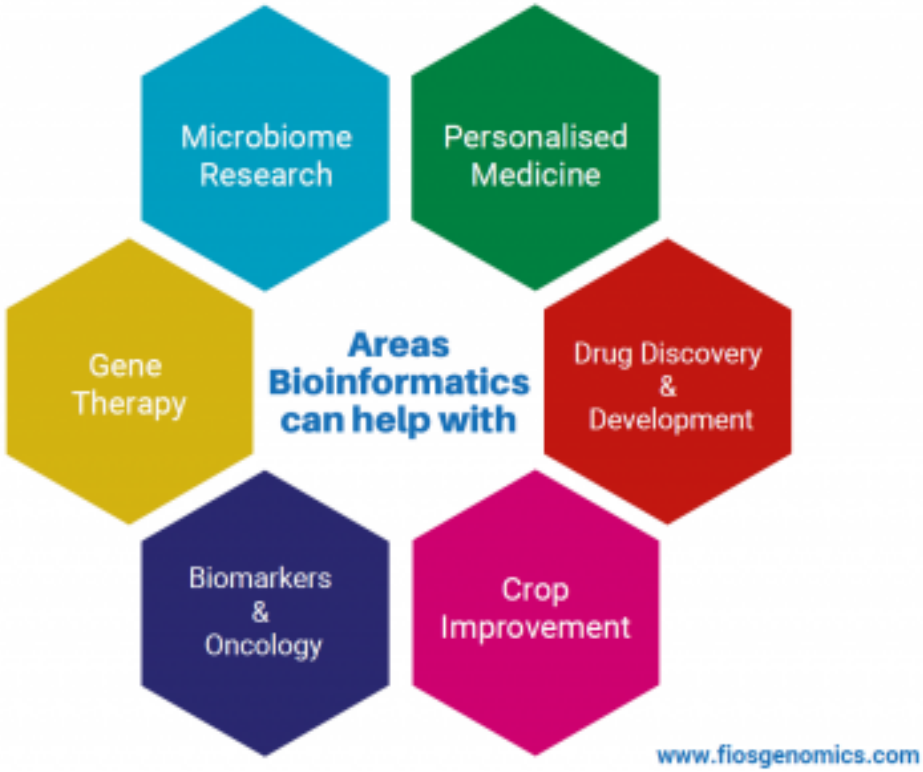

Figure: Areas Bioinformaics can help with.

Gene therapy is an experimental technique that uses genes to treat or prevent disease. In the future, this technique could insert a gene into a patient's cells instead of using drugs or surgery.

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References I

N. M. Luscombe, D. Greenbaum, and M. Gerstein, "What is bioinformatics? a proposed definition and overview of the field," *Methods of information in medicine*, vol. 40, no. 04, pp. 346–358, 2001.

J. Xiong, *Essential bioinformatics*. Cambridge University Press, 2006.

J. M. Archibald, *Genomics: A Very Short Introduction*. Oxford University Press, 2018, vol. 559.

vmachacaa@unsa.edu.pe