Mini Project: Comprehensive Sequence Analysis of the Human TNF Gene

Project Title:

Comprehensive Sequence Analysis of the Human TNF Gene

Objective:

To apply bioinformatics skills to download, analyze, and interpret the sequence of the human TNF gene, which encode a proinflammatory cytokine call TNF.

Project Overview:

In this mini project, you will perform a series of bioinformatics tasks using the human TNF gene as your sequence of interest. The project will guide you through downloading the sequence, translating it, finding ORFs, analyzing sequence composition, identifying transcription factor binding sites, searching for functional motifs, predicting coding/non-coding regions, and converting sequence file formats.

Task 1: Download a Biological Sequence from NCBI and View/Edit It

Objective:

Download the human TNF gene sequence and view it using BioEdit.

Instructions:

- Access the NCBI homepage at NCBI.
- Search for the human TNF gene using the term 'human TNF gene.'
- Locate the correct sequence record (e.g., 'Homo sapiens TNF').
- Download the sequence in FASTA format.
- Open the sequence in BioEdit and view/edit it.

Output:

Take a screenshot of the sequence display in BioEdit

Task 2: Generate a Translation of a DNA or RNA Sequence into Amino Acids

Objective:

Translate the DNA sequence of the TNF gene into an amino acid sequence.

Instructions:

- Open the downloaded TNF gene sequence in BioEdit.

- Use the 'Translate' feature in BioEdit to generate the amino acid sequence.

Output:
Take a screenshot of the amino acid you generated in BioEdit.

Task 3: Find ORFs (Open Reading Frames) in a DNA or RNA Sequence

Objective:
Identify the ORFs within the TNF gene sequence.

Instructions:
- Use BioEdit's ORF Finder tool to find ORFs in the TNF gene sequence.
- Record the start and stop positions, lengths, and protein translations of the ORFs.

Output:
Take a screen short of ORF in BioEdit and Interpret your results in 5 sentences in a word document

Task 4: Analyze Sequence Composition (Nucleotide or Amino Acid Frequencies)

Objective:
Analyze the nucleotide composition of the TNF gene sequence.

Instructions:
- Use BioEdit to analyze the sequence composition of the TNF gene.
- Calculate the frequencies of each nucleotide and the overall GC content.
- Interpret the results and save the analysis.

Output:
Take a screen short of BioEdit showing your result and interpret your results (max: 5 sentences in a word document)

Task 5: Identify Transcription Factor Binding Sites Using the PROMO Tool

Objective:
Identify potential transcription factor binding sites in the TNF gene promoter region.

Instructions:
- Access the PROMO tool at PROMO.
- Select 'Homo sapiens' as the species.
- Input the promoter region of the TNF gene or use the entire gene sequence.
- Identify potential transcription factor binding sites .

Output:

Screenshot your result and comment on it(max: 5 sentences)

Task 6: Search for Functional Motifs in a Genome or Transcriptome Using MEME Suite

Objective:

Search for functional motifs in the TNF gene sequence using MEME Suite.

Instructions:

- Access the MEME Suite at MEME Suite.
- Upload the TNF gene sequence in FASTA format.
- Use the default settings to search for motifs.
- Interpret and save the results of the motif search.

Output:

Screenshot your result and interpret it(sentence limit: a paragraph)

Task 7: Predict Coding/Non-Coding Regions in a Genome Using GENSCAN

Objective:

Predict the coding and non-coding regions within the TNF gene sequence.

Instructions:

- Access the GENSCAN tool or run it locally if installed.
- Input the TNF gene sequence in the appropriate format.
- Run the analysis to predict coding and non-coding regions.
- Save and interpret the results.

Output:

Screenshot your result and interpret it(max: 5 sentences)

Task 8: Convert Between Sequence File Formats Using BioEdit (FASTA to PHYLIP)

Objective:

Convert the TNF gene sequence from FASTA format to PHYLIP format.

Instructions:

- Open the TNF gene sequence in BioEdit.
- Use the 'Save As...' feature to convert the file to PHYLIP format.
- Verify the conversion by opening the PHYLIP file in a text editor.

Output:

TNF gene sequence in PHYLIP format.

Submission Guidelines:

- Create a report documenting the output of each task of the project, including screenshots and explanations of the results.
- Include all files generated during the project (FASTA and PHYLIP file).
- Submit the report and files as a folder on your github.