Bioinformatics :

This case studies demonstrate it's crucial role in personalised medicine, cancer research, drug discovery, and the study of infectious diseases.

- Bioinformatics is essential for this process, from data analysis to targeted therapy design.

1. Personalised Medicine :

Case study : BRCA1 and BRCA2 genetic testing.

Context : variations in BRCA 1/2 genes increase breast and ovarian cancer risk

(BRCA1 → Breast cancer gene 1)

Bioinformatics Role : Genomic sequencing and data analysis identify harmful variants.

Outcome : Helps doctors provide preventive care and targeted treatment based on individual genetic risk.

2. Cancer Research :

(combines DNA, RNA, proteins & metabolites all at once)

case study : Multi omics analysis in small cell lung cancer (SCLC)

Context : SCLC is aggressive and drug-resistant.

Bioinformatics role : integrated mRNA, protein and phosphorylation data to find molecular subtypes.

Outcome : Discovered new targeted therapies suited to each subtype.

3. Drug Discovery & Repurposing:

Case study : Drug repurposing for COVID-19

Context : urgent need for COVID-19 treatments

Bioinformatics Built protein-protein interaction n/w's to find Existing
role : drugs that could target the virus.

outcome : Identified potential antiviral compounds through virtual screening and molecular docking.

4. Infectious Disease Tracking :

Case study : Tracking Drug Resistance in Tuberculosis (TB)

Context : TB caused by drug-resistant Mycobacterium tuberculosis

Bioinformatics role : Genome sequencing to identify mutations linked to resistance and track strain Evolution.

outcome : Enabled faster diagnosis and better TB Control strategies.

② Information display:

(simple agents work together to solve complex tasks)

NIC uses ideas from nature like Evolution, swarm behaviour, and neural activity to create better ways of displaying and visualising complex data.

i) Swarm intelligence for n/w visualization :

prblm: Large, complex n/w's are hard to visualise clearly.

solution: A bee colony-inspired swarm alg positions Each node (bee) by local interactions.

Result: self organised, clutter free and efficient n/w visualisations.

ii) Genetic Alg's for Data visualisation:

Prblm: creating readable and attractive visualisations involves multiple conflicting goals.

Sol'n: A GA evolves many visualization designs using fitness functions.

Result: Automatically generates optimised, diverse and visually appealing data displays.

iii) Ant colony optimisation for Route visualisation:

prblm: showing a driver's optimised delivery route clearly is difficult with many stops.

Sol'n: ACO simulates ants finding shortest paths using pheromones.

Result: Displays the shortest and most efficient routes improving navigation and logistics.

iv) - Artificial Neural N/w's for Medical imaging :

Prblm: Medical images often have noise & unclear details

Sol'n: ANN's are trained to remove noise and enhance
image quality.

Result: clearer, detailed medical images for accurate
diagnosis & faster decision making.