

## Supplemental Material 1.

### Pure and Applied Scientific Aspects of Bioinformatics

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#### ***1. The Role of Bioinformatics in Genomics and Proteomics***

A. Human Genome Project (HGP) employs bioinformatics for clinical use to:

- Improve the diagnosis and early detection of disease
- Enable gene therapy and other clinical applications
- Create risk assessment techniques for genetic predispositions and reduce the likelihood for heritable mutations
- Further the understanding of fundamental biological mechanisms

B. Microbial Genomics employs sequence analysis to rapidly detect existing and novel micro-organisms/viruses to:

- Screen databases of pathogen genomes to promote drug and vaccine development
- Help monitor and clean environments
- Protect from biological warfare
- Contribute to knowledge of disease and other clinical uses
- Help identify/classify novel organisms

C. Other Genome Projects for a variety of organisms establish genetic models to support scientific research projects involving:

- The advancement of the agriculture/food industry
- Identification of homologous genes in humans/other organisms

D. Evolutionists and Taxonomists utilize sequence analysis tools to:

- Modify existing evolution theory
- Further understand evolution through nucleotide/protein sequence mutations
- Juxtapose historical events against the evolutionary patterns of mutation.
- Identify novel species/subspecies through nucleotide/protein sequence analysis
- Establish genetic homologies between and within species
- Study the migrations of populations through both female and male inheritance
- Create phylogenetic trees based on nucleotide/protein sequence similarities among/between organisms

E. Promote drug design (pharmacogenomics)

F. Predict Protein folding for a variety research and industrial applications

G. Analyze/predict bio-molecule interactions

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#### ***2. The Role of Bioinformatics in Systems Biology***

Systems biology holistically investigates complex biological pathways to understand:

- Multiple gene interactions
  - Complex Protein/Protein interactions
  - Complex Protein/DNA interaction
  - Holistically model cell, organ and organism function
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## Bioinformatics from a Socio-scientific Perspective: Ethical, Moral and Legal Concerns

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1. Access to stored biological information leads to control over database funding and possible use/misuse by employers, courts, law enforcement, health insurance companies, adoption agencies, the military and others.
  2. Concerns arise regarding quality control for accuracy of test results that rely on biological computer databases.
  3. Sequence analysis tools encourage the characterization of human identities, with the potential to start a new eugenics movement.
  4. The development of various bioinformatics tools raises sociological concerns and potentialities for example:
    - A. Internet based searching tools can provide the public with access to biological data.
    - B. Commercial computer programs generate cladograms and other images that can represent novel interpretations confronting existing scientific theories.
    - C. Increasing database development enable:
      - The identification of DNA at scenes of crime and natural catastrophes
      - The exoneration of the wrongly convicted felons
      - The facilitation of paternity suits and establishing family relations
      - The identification of endangered and threatened species
  5. Advancement of *Systems Biology* promotes the:
    - A. Enhancement of biological function (intelligence, performance, etc.).
    - B. Understanding of brain function enabling the more efficient development of artificial intelligence.
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