1. **Chapter 1**
   Introduction to Genetics
2.
   - Hopi tribes
     - Albinism
     - Culture & frequency
3. **1.1 Importance**
   - Genes affect
     - Height
     - Weight
     - Hair color
     - Skin pigmentation
     - Susceptibility to diseases & disorders
     - Intelligence
     - personality
4.
   - Applications of genetics
     - Agriculture
       - Disease
       - Pest resistance
       - Frost resistance
       - Nutritional characteristics
     - Pharmaceuticals
       - Additives
       - Hormones
     - Industry
       - Minerals
       - Toxic chemicals
5.
   - Disciplines
     - Evolution
     - Developmental biology
     - Taxonomy
     - Ecology
     - Animal behavior
     - Medicine
6.
   - Unifying principle
     - All organisms use the same genetic system
   - Genome
     - Complete set of genetic instructions for any organism
     - Composed of nucleic acids (DNA or RNA)
       - Universal
       - Evolution
       -
7.
   - Transmission genetics
     - Classical
     - Focus on individual organism
   - Molecular genetics
     - Chemical nature of gene
     - Focus on gene

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- Population genetics
  - Study of evolution
  - Focus on group of genes in a population

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- Model genetic organisms
  - Bacteria
    - *Escherichia coli*
  - Fungi
    - *Saccharomyces cerevisiae*
  - Plants
    - *Arabidopsis thaliana*
  - Animals
    - *Caenorhabditis elegans*
    - *Drosophila melanogaster*
    - *Mus musculus*

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- Using model organisms for human questions
  - Zebrafish

10 **1.2 History of genetics**

- Genetics discipline
  - ~100 years
- Genetics applications & questions
  - ~ 12,000 years
  - Domestication of plants & animals (Middle East)
  - Hindu scared writings
    - 2000 years ago
  - Jewish religious laws
    - Hemophilia
    -

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- Theories
  - Pangenesis
    - 520 B.C.
    - Gemmules carry information to reproductive organs
    - Inheritance of acquired characteristics
      - ☐Aristotle – struggle between male & female gemmules
  - Preformationism
    - Microscopes
      - ☐Robert Hooke 1665
    - Homunculus
      - ☐Ovists
      - ☐Spermists
    - Blending inheritance
      - ☐Traits mix like paint (inseparable)
        - ☐Not discrete units like logos (can be resorted)

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- Science of Genetics
  - Nehemiah Grew 1676
    - Plants use pollen for sexual reproduction
  - Joseph Kolreuter
    - Studied crosses & hybrids
    - Did not find general pattern

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- Gregor Mendel
  - Crossed one trait at a time
  - Found general pattern

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- Cell Theory
  - Matthais Schleiden & Theodor Schwann
    - ☐Plants & animals composed of cells
  - Robert Brown – nucleus
    - ☐Cells arise from preexisting cells
    - ☐Cell is fundamental unit of life
  - Charles Darwin
    - ☐On the Origin of Species 1859
      - ☐Heredity fundamental to evolution
      - ☐Descent with modification
  - Walther Flemming
    - ☐Mitosis
  - August Weismann
    - ☐Germ-plasm theory
      - ☐Complete set of genetic information passed to egg & sperm

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- Walter Sutton
  - Genes on chromosomes
- Thomas Hunt Morgan
  - Mutant fruit flies
- Roslind Franklin, Maurice Wilkins, James Watson & Francis Crick
  - Structure of DNA
- Walter Gilbert & Frederick Sanger
  - DNA sequencing methods
- Kary Mullis
  - PCR
- 1990's-present
  - Gene therapy, Human Genome Project & genome sequencing

15 **Basic Concepts in Genetics**

- Cell types
  - Prokaryotic & eukaryotic
- Gene is fundamental unity of heredity
- Genes come in multiple forms (alleles)
- Genes encode phenotypes
- Genetic information in DNA & RNA
- Genes located on chromosomes

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