Reading DNA into RNA

- To crack the genetic code found in DNA we need to look at the sequence of bases.

- The bases are arranged in triplets called codons.

A G G - C T C - A A G - T C C - T A G

Complementary DNA

Complementary RNA

How does the ribosome do it?

1st it can only work with RNA, so we need to turn

DNA→RNA

Replication

Transcription   Translation

DNA ——→ RNA ——→ Proteins

Transcription

- RNA forms base pairs with DNA
  - C-G
  - A-U
- RNA Polymerase does the matching

Complementary DNA strands   RNA strand
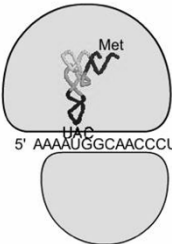

Transcription and Translation Order

Replication

Transcription   Translation

- DNA ——→ RNA ——→ Proteins

✔ DNA

✔ DNA → RNA (change the T's to U's)

3. Codons (start at Met – AUG)

4. Ribosome reads Codons into Amino Acids

5. Amino Acids strung together with peptide bonds

6. Protein

Translation

- Second stage of protein production
- mRNA is on a ribosome

Met

But where does the ribosome start?

UAC
5' AAAAUGGCAACCCUCAUGAAACGACAUUGAAAAAA 3'

AUG – Codes for Methionine

Mutants!

www.youtube.com

What Are Mutations?

- Changes in the nucleotide sequence of DNA
  - May occur in somatic cells (aren't passed to offspring)
  - May occur in gametes (eggs & sperm) and will be passed to offspring

Original

Original

Correct copy

Mutant copy

biology.stackexchange.com

Cause of Mutations?

Cause: Mutagens AKA Carcinogens
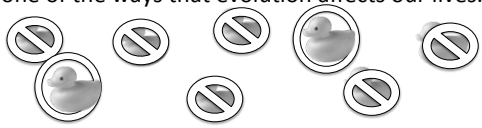
www.newsmax.com

Are they Good, Bad or Neither

- **Good**: Fuel for Evolution
- **Bad**: Often screw up protein
- **Neutral**: Most don't affect the protein or an enzyme can fix it.

www.ck12.org

Good Mutations: Biology and Society: Mosquitoes, Microbes, and Malaria

— The evolution of pesticide-resistant insects is just one of the ways that evolution affects our lives.
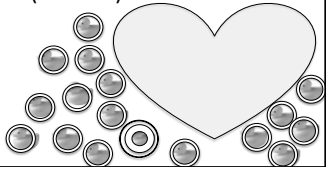
DDT

— Survival of the fittest (luckiest)

An understanding of evolution informs every field of biology, for example,
- Medicine,
- Agriculture,
- Biotechnology
- Conservation biology.

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Mutations Affect of Protein

Normal Protein:
- **DNA:** ACCATGCCCCGTTGATTT
- **RNA**: ACC**AUG-**CCC-CGU-UGA-UUU
- **Protein**: MET-PRO-ARG-STOP

Mutation:
- **DNA**: ACCATGⒶCCCGTTGATTT
- **RNA:** ACC**AUG**-CCC-GUU-GAU-UU
- **Protein:** MET-VAL-VAL...DOESN'T STOP

?:
Good
Bad
Neutral

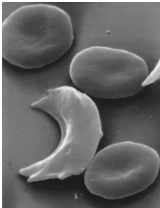## Types of Gene Mutations

Include:
- **Point Mutations:** Single nucleotide is changed
- **Substitutions**: Swap one nucleotide for another
- **Frameshift**: Bump everything down stream over one.
  - **Insertions**: Add a nucleotide
  - **Deletions**: Delete a nucleotide

Point Mutation
- Change of a **single** nucleotide
- Includes the deletion, insertion, or substitution of **ONE** nucleotide in a gene

Sickle Cell Disease

Wild-type hemoglobin DNA	Mutant hemoglobin DNA
3′ C T T 5′	3′ C A T 5′
5′ G A A 3′	5′ G T A 3′

mRNA	mRNA
5′ G A A 3′	5′ G U A 3′

Normal hemoglobin	Sickle-cell hemoglobin
Glu	Val

bio1151.nicerweb.com

Frameshift Mutation

- **Causes: Inserting or deleting** one or more nucleotides
- Changes the "**reading frame**" like changing a sentence
- **Proteins** built **incorrectly**

Th🚫pig can try. ➔

Thp igc ant ry (no period, might not end correctly)

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Frameshift Mutation

Frameshift mutation

Original DNA code for an amino acid sequence.

DNA bases → C A T T C A C A C G T A C T C A T G C T A T

His — Ser — His — Val — Leu — Met — Leu

↑ Amino acid

🚫 A T T C A C A C G T A C T C A T G C T A T

Ile — His — Thr — Tyr — Ser — Cys — Tyr

Frameshift of one DNA base results in abnormal amino acid sequence.

U.S. National Library of Medicine

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