Alignment Activity

Background
The process of alignment is a way of comparing two or more text-based pieces of information to determine where they match and where they differ. DNA alignment is an important part of sequencing and genetic analysis since it highlights areas of conservation and mutation for further study. This activity uses short, English texts to introduce different concepts and techniques used in alignment.

Demo
First, let’s think of this as a lecture and notes: the known reference is the slides we’ve prepared, and the sequences we were investigating are like a student’s notes. We should be able to compare any student’s notes to the lecture and determine which slide they correspond to, even if they don’t match exactly.

Here’s some examples of student notes:

<table>
<thead>
<tr>
<th>Types of Seq</th>
<th>Types of Sequencing Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>De novo</td>
<td>De novo</td>
</tr>
<tr>
<td>First time Seq</td>
<td>Used first time gene/genome sequenced</td>
</tr>
<tr>
<td>“Stitching” together</td>
<td>Stitching together short sequences</td>
</tr>
<tr>
<td>Resequencing</td>
<td>Resequencing</td>
</tr>
<tr>
<td>Lit. “seq again”</td>
<td>Sequencing again</td>
</tr>
<tr>
<td>Allows comparison “reference”</td>
<td>Allows for comparison with “reference”</td>
</tr>
</tbody>
</table>

And here’s the slide they were taken from:
When we compare the texts exactly, that’s alignment.

There’s some things worth noting about this format

- Texts are shown line by line
- “Deletions”, when something is in one text but not another, are indicated by the symbol –
- “Insertions” in one text get treated as deletions in the other texts, even if there was nothing ‘deleted’ (see the quotation marks in Notes1 vs the reference Slide)
- “Substitutions”, when a single letter is changed for another, can be hard to spot just in the text itself
- The symbol * is used to indicate the positions where every sequence matches exactly, this makes spotting substitution easier, and gives a quick visual check for how well they texts aligned.

Directions
Print out the “references”, the correctly formatted quotes.

Print out the “reads”. Student will need scissors and tape to align, and markers to indicate perfect matches or deletions.

For each quote, have students create an alignment sheet of the various reads. They should indicate deletions, insertions, and perfect matches as described above. Students can be in groups, and each group can focus on one quote.

For ease, punctuation and capitalization has been kept unchanged.

Example:
Ref: Mr. and Mrs. Dursley, of number four, Privet Drive
1st: Mr. and Mrs. Durzley, of number four, Privet Drive
2nd: Mr. and Ms. Dursly, of number four, Privett Drive
3rd: Mr. and Mrs. Durley, of number four, Privet Drive, were proud

Ref: Mr. and Mrs. Dursley, of number- four, Privet- Drive-----------
1st: Mr. and Mrs. Dursley, of number- four, Privet- Drive-----------
2nd: Mr. and M- s. Dursl- y, of number- four, Privett Drive-----------
3rd: Mr. and Mrs. Dursley, of number- four, Privet- Drive, were proud

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slide: Types of Sequencing Analysis De novo Assembly Used the first
Note1: Types ----Seq------ Analysis De novo -----------------first
Note2: Types of Sequencing Analysis De novo ---------------Used ----first

slide: time a gene- or genome is ever sequenced -Stitching- together
Note1: time -----------------------------seq------ “Stitching” toghether
Note2: time --gene/----genome -----------sequenced -Stitching- together

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slide: time a gene- or genome is ever sequenced -Stitching- together
Note1: time -----------------------------seq------ “Stitching” toghether
Note2: time --gene/----genome -----------sequenced -Stitching- together
That's one small step for man. One giant leap for mankind.

Alas, poor Yorick! I knew him, Horatio: a fellow of infinite jest

The quick brown fox jumps over the lazy dog.
That’s one small step for a man. One giant leap for mankind.

That’s one smell step for man. One giantleep for mankind.

That’s fun smallstep for a man. One gaint leap for man kind.

Alas, poor Yorick! I knew him well Horatio: a fellow of infinite jest.

Alas, poor Yorick! I kne whim Horation:a fallow ofininfinitely jest.

Alas, poor Yorick! I knew him Horatio: a man of infinite jest.

The quick brown fox jumps over the lazy dog.

The qui ck brown foxj umps ovor the laz doge

The quik brown fix jumbs overth e lazy dog.