

Functions, functions, functions!

Kevin Bonham, PhD :: BISC195- Summer 2021

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Outline

Functions,
functions,
functions!

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PhD :: BISC195-
Summer 2021**

Some note on the
course

Using Functions

Lab 3:
Needleman-Wunch
Alignment, part 1

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Lab 3: Needleman-Wunch Alignment, part 1

Course philosophy

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Alignment, part 1

Scientific literature suggests that the best way to learn is

- ▶ Spaced repetition
- ▶ Practice
- ▶ Rapid feedback
- ▶ “Desirable difficulty”
- ▶ Repetition that is spaced out

Keep the corrections coming

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Alignment, part 1

- ▶ Jess is in the lead with Anika and Clara hot on her tail
- ▶ Never too early to ask if I'm wrong
 - ▶ If I am, you get point (for bragging rights, not grades)
 - ▶ If I'm not, you still might learn something
- ▶ Assignments are meant to make you work, but not too hard (Not all difficulty is desirable)

Assignments and feedback

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Alignment, part 1

- ▶ Ask for review on github issues
 - ▶ If I haven't responded within 2 days, ping me @kescobo
- ▶ Check on automated tests (locally or on push)
- ▶ OK to push multiple times, don't wait until you're done

Lab Grading: More details in today's lab

Functions are reusable bits of code

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Alignment, part 1

- ▶ Some functions don't take arguments
 - ▶ `pwd` in the terminal
 - ▶ `now()` in julia
- ▶ Some functions always take arguments
 - ▶ `mv <source> <destination>` (shell)
 - ▶ `parse(Int, "42")` (julia)
- ▶ Some functions *can* take arguments, but have defaults
 - ▶ `ls` lists the current directory (equivalent of `ls $(pwd)`)
 - ▶ `ls <path>` lists the contents of `<path>`
 - ▶ `println()` just prints an empty line
 - ▶ `println(args...)` prints all args concatenated
 - `println("some string", " ", "other string")`

Julia functions may have many “methods”

- ▶ a method of a function is one that takes different numbers or kinds of arguments
- ▶ any function may have any number of methods

- ▶ No args:

```
function foo()
    println("Base foo! No args")
end
```

- ▶ 1 arg:

```
function foo(arg1)
    println("One arg foo!")
    println(arg1)
end
```

- ▶ more specific 1 arg:

```
function foo(arg1::Number)
    println("Number foo! $arg1")
    return arg1 * 10
end
```

Julia functions can have “default” args

- ▶ defaults are shortcuts for defining multiple methods

```
function my_func(a = 1)
    @info "the value of a is" a
end # how many methods does this lead to?
```

- ▶ Be careful! Using defaults can overwrite conflict with other methods

```
function my_func()
    @info "wait wait"
end
```


Don't rewrite code - call functions!

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```
# if you have...
function complement(sequence)
    # ...
end

function reverse_complement(sequence)
    rev = reverse(sequence)
    return complement(rev) # call it!
end
```

When functions are getting long, re-write chunks as functions

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Alignment, part 1

- ▶ Smaller units are easier to understand
- ▶ Smaller units are easier to test
- ▶ Smaller units are easier to debug

Needleman-Wunch is a local-alignment algorithm

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Alignment, part 1

Premise: Given two sequences, what is the best alignment?

Eg:

Seq1: AATCAAGTTAGATCGAT

Seq2: AAGCA--TTAGAC-GGT

- ▶ What question is an alignment setting out to answer?
- ▶ What does an alignment represent?
- ▶ What does “Best” mean?

Composition of alignments

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Alignment, part 1

- ▶ **Match**: Each sequence has the same element (nucleotide or amino acid) in that position
- ▶ **Mismatch**: Each sequence has a different element in that position
- ▶ **Gap**: Also called InDel (insertion/deletion), one sequence has an element at a position, while the other does not

Alignment Scoring

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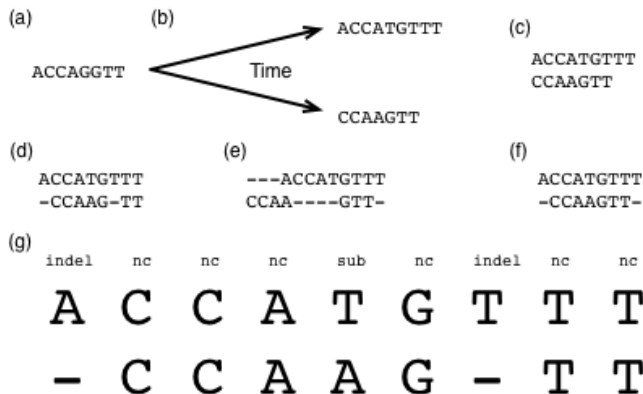
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- ▶ Each position can be given a numerical “score”
- ▶ Original paper used
 - ▶ Match: +1
 - ▶ Mismatch: -1
 - ▶ Gap: -1
- ▶ May also distinguish between “Gap open” and “Gap extend” scores

An alignment represents a hypothesis about evolutionary history



Source

Watch the video

- ▶ Where indicated, pause video and try to answer the questions
- ▶ Video is ~12 min, will return in 25 min
- ▶ Video link: https://youtu.be/_Id3uWpdXUs

Complete the lab

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1. Fork the “Labs” repository on github
2. Indicate who you’re partnered with (use their github handle)
3. Follow the instructions for Lab3