energy conversion challenge

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Energy Conversion Challenge

Measures of the amount of energy used by biological processes are critical to understanding many aspects of biology from cellular physiology to ecosystem ecology.

There are many different units for energy and their utilization varies across methods, research areas, and lab groups.

1. Write a function called convert_energy_units(energy_value, input_unit, output_unit) to convert units between the following energy values:

- Joules(J),
- Kilojoules(KJ),
- Calories(CAL),
- and Kilocalories (KCAL; this unit is used for labeling the amount of energy contained in food). A Kilojoule is 1000 Joules, a Calorie is 4.1868 Joules, a Kilocalorie is 4186.8 Joules. An example of a call to this function would look like:

energy_in_cal <- 200 energy_in_j <- convert_energy_units(energy_in_cal, "CAL", "J")

```
convert_energy_units <- function(energy_value, input_unit, output_unit) {
  if (input_unit == "J" & output_unit == "KJ") {
    energy_in_KJ <- energy_value*1000
  } else if (input_unit == "J" & output_unit == "CAL") {
    energy_in_CAL <- 1/4.1868*J
  } else if (input_unit == "J" & output_unit == "KCAL")
    energy_in_CAL <- 1/4186.8*J
}
```

```
energy_in_cal <- 200
# "J"*100
energy_in_j <- convert_energy_units(energy_in_cal, input_unit = "CAL", output_unit = "J")
energy_in_j
```

```
## NULL
```

```
convert_energy_units <- function(energy_value, input_unit, output_unit) {
  if (input_unit == "J" & output_unit == "CAL") {
    energy_in_cal <- energy_value/4.184
    print(energy_in_cal)
  } else if (input_unit == "J" & output_unit == "KJ") {
  energy_in_kj <- energy_value/1000
  print(energy_in_kj)
  } else if (input_unit == "J" & output_unit == "KCAL") {
  KCAL <- energy_value/4184
  print(energy_in_kcal)
```

```
  } else if (input_unit == "CAL" & output_unit == "J") {
   energy_in_j <- energy_value * 4.1868
   print(energy_in_j)
  } else if (input_unit == "KCAL" & output_unit == "J") {
    energy_in_j <- energy_value * 4186.8
    print(energy_in_j)
  }  else if (input_unit == "KJ" & output_unit == "J") {
    energy_in_j <- energy_value*1000
    print(energy_in_j)
  } else {
    print("Sorry, I don't know how to convert")
  }
}
```

```
convert_energy_units(2500, "KCAL", "J")
```

```
## [1] 10467000
```

2. Make this function more efficient by using if else statements. If either the input unit or the output unit do not match the five types given above, have the function print - "Sorry, I don't know how to convert " + the name of the unit provided.

Tip: Instead of writing an individual conversion between each of the different currencies (which would require 12 if statements) you could choose to convert all of the input units to a common scale and then convert from that common scale to the output units. This approach is especially useful since we might need to add new units later and this will be much easier using this approach.

3. Use your function to answer the following questions:

a) What is the daily metabolic energy used by a human (~2500 KCALs) in Joules.

```
convert_energy_units(2500, "KCAL", "J")
```

```
## [1] 10467000
```

b) How many times more energy does a common seal use than a human? The common seal uses ~52,500 KJ/day (Nagy et al. 1999). Use the daily human metabolic cost given above.

```
# Solution 1: convert seal kilojoules to kilocalories and compare to human kilocal
convert_energy_units(52500, "KJ", "KCAL")
```

```
## [1] "Sorry, I don't know how to convert"
```

```
#Solution 2: convert seal kilojoules to joules and compare to human joules
convert_energy_units(52500, "KJ", "J")
```

```
## [1] 52500000
```

c) How many ergs (ERG) are there in one kilocalorie. Since we didn't include the erg conversion this should trigger our 'don't know how to convert' message.