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| **Decision point** | **Description** |
| Biological context? | Are we dealing with a case of biological function or colloquial use (see [WordNet 3.1](http://wordnetweb.princeton.edu/perl/webwn?s=function&sub=Search+WordNet&o2=&o0=1&o8=1&o1=1&o7=&o5=&o9=&o6=&o3=&o4=&h=) for colloquial definitions)? Colloquial examples are rare if one restricts the corpus to scientific papers in biology. Notable exceptions are mathematical functions and programming functions, which we place within Colloquial to simplify the flowchart. |
| Technical use? | Compound phrases such as "functional ecology", "functional biology", "functional connectivity", and so on. These phrases will be familiar to practitioners within a field. Their meanings are multi-faceted and influenced by a field's development and cannot be meaningfully unpacked using a flowchart. These phrases will often appear multiple times in a manuscript. |
| Identify *ITEM* | An *ITEM* is something that can be a character or trait (or produced by one) of a Darwinian individual. Obvious candidates are concrete nouns, which refer to a physical item (e.g. heart), but it also includes abstract nouns if they refer to a concrete concept (e.g. "gene" as used in population genetics, "boldness" as a behavioural phenotype, etc.). Importantly, there must be a grammatical dependency between function and the *ITEM*—it is not sufficient that a suitable *ITEM* simply appear in the sentence (e.g. "protein" is the *ITEM* in “protein function aids muscle development" but "muscle" is the *ITEM* in "protein aids in muscle function"). |
| Identify *ITEM*'s *EFFECT* | *EFFECT* is what the *ITEM* does (or, less commonly, has done to it). *EFFECT* is a verb or verb phrase, or it is a word or phrase that can be converted into a verb (e.g. "contribute to transcription" could be converted to the verb "transcribe"). *EFFECT* must be a mechanistic action or effect of the *ITEM* (e.g. if *ITEM* is "gene" then "is transcribed" is acceptable but "benefits health" is not). |
| Is function used in the sense of To Work? | A heuristic is whether you can substitute "*ITEM* function" (or equivalent, depending on the sentence) with "how well *ITEM* performs", "a working *ITEM*", or similar into the raw sentence without loss of meaning. For example, "Liver function is important for health" might become "A working liver is important for health" without loss of meaning. |
| Did doing *EFFECT* select for *ITEM* historically? | Can it fit the following form: the function of *ITEM* is to *EFFECT* such that doing *EFFECT* in the past caused *ITEM* to be selected or maintained in a population (relative to an actual or counterfactual historical alternative to *ITEM*)? An example would be "zebra stripes are functional because they evolved to reduce insect bites" as reducing insect bites (*EFFECT*) has selected for zebra stripes (*ITEM*). |
| Identify *SYSTEM* | A *SYSTEM* is either a Darwinian individual, or a complex system within an individual, that contains the *ITEM*. The *EFFECT* of the *ITEM* on the *SYSTEM* contributes to a capacity of the *SYSTEM*. As a heuristic for identifying the *SYSTEM*, you can ask "how does *ITEM* produce *EFFECT*?" or "for what is *ITEM* producing *EFFECT* used?". |
| Is the function of *ITEM* *EFFECT* in *SYSTEM* and *EFFECT* benefits *SYSTEM* (or *SUPERSYSTEM*)? | Consider "Transcript X functions to regulate expression in the liver, which improves liver performance through regulation of glycogen storage.". We can unpack this as "The function of *TRANSCRIPT X* is to *REGULATE EXPRESSION* in *GLYCOGEN STORAGE IN THE LIVER* and *REGULATING EXPRESSION* benefits [improves performance of] *THE LIVER"*. Note the statement's contrastive nature: "improves liver performance" indicates that transcript X is being compared to an (unstated) alternative (e.g. transcript Y). Although contrast will often occur, it is not required. For example, we would still classify this example as Biological Advantage if we replaced "improves liver performance" with "aids metabolic control". Although this alteration removes the contrast, it nevertheless describes a benefit to a supersystem (metabolic system). (A *SUPERSYSTEM* is a system that contains *SYSTEM* up to and including the level of a Darwinian individual.) |
| Is the function of *ITEM* *EFFECT* in *SYSTEM*? | Biological Role is not contrastive, and it does not contain language indicating a benefit to a system (or supersystem). An example is "Transcript X functions to regulate expression in the liver, which plays a role in regulation of glycogen storage". This statement neither contrasts transcript X with an alternative—it simply describes how transcript X contributes to a capacity of the *SYSTEM*—nor explicitly describes a benefit to the *SYSTEM*. |
| Is the function of *ITEM* *EFFECT*? | Biological Activity is Biological Role without a *SYSTEM* being specified. An example is "Transcript X functions to regulate expression", which simply describes what transcript X does. We do not know how (or in what system) it is being used. |