

## Maintaining Linkage: More examples

UW BACTER Institute, Dec. 2009

A common problem in scientific writing is a lack of linkage between sentences. That is, sentences tend to sound like collections of stand-alone bullet points, because the connections between the ideas expressed in each sentence are not made clear. The result is a disjointed paragraph that readers have to work hard to follow. And if readers have to work too hard, they stop reading.

So how do we link sentences together to create a coherent, readable whole? In the accompanying presentations, *Achieving a Readable Style: Sentences, Parts 2 and 3*, among the strategies discussed were: 1) using **connecting words** (then, thus, however, etc.), and 2) placing information into the **topic position** of a sentence (i.e., the start of the sentence) that **links backward** to the previous one and provides context for understanding the new information to come. Below are a few more examples that illustrate how these strategies foster readability.

1) In the passage below, connecting words are highlighted in blue and topic positions that link backward in green. (Slight changes were made in some places, but overall these authors did a very good job of maintaining linkage.)

In metazoans, oxygen concentration is monitored by the hypoxic response pathway, where hypoxia-inducible factors (HIFs) regulate numerous genes in response to oxygen. **HIF proteins** are heterodimeric basic helix–loop–helix Per-ARNT-Sim (bHLH-PAS) transcription factors whose activity is regulated in an oxygen-dependent manner. **With adequate oxygen levels** (normoxia), oxygen-dependent hydroxylations of the HIF $\alpha$  subunit block interactions with CBP/p300-family coactivator proteins and also trigger its ubiquitin-mediated degradation. **Under low-oxygen conditions** (hypoxia), **on the other hand**, unmodified HIF $\alpha$  subunits bind the aryl hydrocarbon receptor nuclear translocator (ARNT, also known as HIF $\beta$ ) protein, forming the transcriptionally active heterodimer. **Thus**, cells translate environmental oxygen concentration into altered gene expression. HIF proteins are of considerable interest because of their roles in promoting solid growth and resistance to chemotherapy.

Both HIF $\alpha$  and ARNT contain an N-terminal bHLH DNA binding domain and two adjacent PAS domains, referred to as PAS-A and PAS-B. **PAS domains** are structural modules found in proteins from all kingdoms of life that have significant structural homology despite little conservation of amino acid sequence. **PAS domains** often serve as protein–protein interaction components, as in the case of HIF $\alpha$  and ARNT, where they are needed for assembly of the HIF2 PAS-B heterodimer via their  $\beta$ -sheet surfaces. **For many PAS domains, these protein/protein interactions** can be environmentally regulated by internally bound small molecules or cofactors, including flavin adenine dinucleotide (FAD), flavin mononucleotide (FMN), heme, or 4-hydroxycinnamic acid. **For example**, flavin-binding PAS domains serve as blue-light photoreceptors in bacteria and plants and assess energy content in bacteria, **while** heme-based PAS domains monitor dissolved gases...

2) Now watch what happens to the first paragraph (section in bold) when 1) the connecting words are removed and 2) the sentences are rearranged so that the



topic positions no longer contain “old” information that helps set up the new information, but the new information itself.

In metazoans, oxygen concentration is monitored by the hypoxic response pathway, where hypoxia-inducible factors (HIFs) regulate numerous genes in response to oxygen. HIF proteins are heterodimeric basic helix–loop–helix Per-ARNT-Sim (bHLH-PAS) transcription factors whose activity is regulated in an oxygen-dependent manner.

**Hydroxylations of the HIF $\alpha$  subunit block interactions with CBP/p300-family coactivator proteins and also trigger its ubiquitin-mediated degradation under adequate oxygen levels (normoxia). Unmodified HIF $\alpha$  subunits bind the aryl hydrocarbon receptor nuclear translocator (ARNT, also known as HIF $\beta$ ) protein, forming the transcriptionally active heterodimer, under low-oxygen conditions (hypoxia). Cells translate environmental oxygen concentration into altered gene expression.** HIF proteins are of considerable interest because of their roles in promoting solid growth and resistance to chemotherapy.

3) Below is a passage in which the authors consistently place new information into the topic positions of sentences. Can you edit it so that linkage is maintained?

The abstraction of the C $\alpha$ -hydrogen of amino acids poses a great challenge due to their low acidity. Typically, the pK<sub>a</sub> values in solution of the amino acid C $\alpha$ -hydrogens are in the range 21–34, depending on the nature of specific amino acid and the pH of the solution. Several enzymes employ the pyridoxal-5'-phosphate (PLP) coenzyme to increase the acidity of the C $\alpha$  hydrogen. The amino acid couples with PLP via a Schiff base link, forming an aldimine moiety, which has a reduced C $\alpha$  pK<sub>a</sub> value.

Here are some suggested changes (in bold):

The abstraction of the C $\alpha$ -hydrogen of amino acids poses a great challenge due to their low acidity. In solution, **amino acid C $\alpha$ -hydrogens** typically have pK<sub>a</sub> values in the range of 21–34, depending on the nature of specific amino acid and the pH of the solution. **To increase the acidity of the C $\alpha$  hydrogen**, several enzymes employ the pyridoxal-5'-phosphate (PLP) coenzyme. **PLP** couples with the amino acid via a Schiff base link, forming an aldimine moiety, which has a reduced C $\alpha$  pK<sub>a</sub> value.

