

Do Sense-Antisense Proteins Really Interact?

Ruchir R. Shah,¹ Todd J. Vision,² Alexander Tropsha³

Keywords: S-AS=Sense Antisense, complementary proteins.

1 Introduction

For each of the 64 codons there is a corresponding *antisense* codon, as shown for the four glycine codons in Table 1. Pairs of proteins encoded by reverse complementary codons, usually from opposite strands of the same coding region, have been dubbed sense-antisense, or S-AS, protein pairs [1]. As can also be seen in this table, there are often multiple antisense amino acids for a given sense amino acid due to the degeneracy of the genetic code [2]. Thus, two protein sequences may have recognizable sense-antisense alignments even when the protein pairs are encoded at different loci and the two coding sequences are not perfect reverse complements of one another (Figure 1).

Whereas specific interactions between complementary mRNA sequences are well known, similar interactions between sense and antisense protein sequences have been a matter of some debate. On the other hand the pool of experimental evidence supporting specific interaction between antisense proteins is growing; see [3] for the most recent comprehensive list. Here in, we address the question of whether sense-antisense protein pairs are of biological significance by seeking to identify all such potential pairs within the yeast proteome. We ask whether such pairs are more abundant than expected by chance and whether there is evidence for functional or physical interaction between the members of each pair. We find over 500 statistically significant Smith-Waterman alignments using a custom sense-antisense scoring matrix with a predicted 25% false positive rate. In addition, we find that sense-antisense pairs have more similar gene expression profiles than random pairs and that they are enriched in protein interaction/protein complex data. Most of the 28 pairwise interactions observed among sense-antisense pairs are due to a network of interactions among only 14 proteins (Figure 2). These results raise a myriad of structural, functional and evolutionary questions regarding sense-antisense proteins.

2 Figures and tables

Sense			Antisense	
Gly	GGA	→	TCC	Ser
Gly	GGC	→	GCC	Ala
Gly	GGG	→	CCC	Pro
Gly	GGT	→	ACC	Thr

Table 1: The antisense amino acids of glycine are the corresponding amino acids encoded by the reverse complement of each codon.

¹Laboratory for Molecular Modeling, School of Pharmacy, UNC-CH, Chapel Hill, NC. E-mail: ruchir@email.unc.edu

²Department of Biology, UNC-CH, Chapel Hill, NC. E-mail: tjv@biomass.bio.unc.edu

³Laboratory for Molecular Modeling, School of Pharmacy, UNC-CH, Chapel Hill, NC. E-mail: tropsha@email.unc.edu

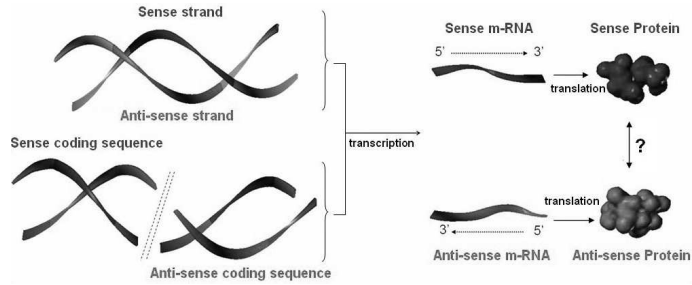


Figure 1: A sense and antisense protein pair can be encoded by genes at the same genetic locus (top left) or at different loci (bottom left). The possible interaction between proteins is indicated by a question mark.

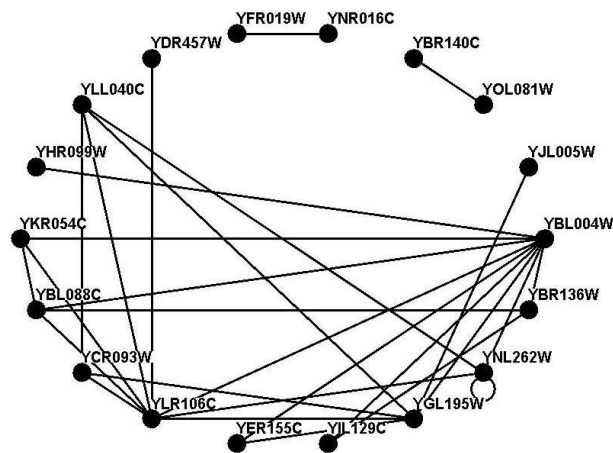


Figure 2: S-AS interacting protein network: All 28 interacting S-AS protein pairs were used to generate the network using the software *Osprey* [4]. Each node in the network represents a protein; An edge connecting two nodes means that the nodes are antisense with each other and are also found to be interacting.

3 References and bibliography

References

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