# Relevance of proteins enriched in Caviar Oil to pet’s health

Several of the proteins enriched in sturgeon roe sack (placenta) have potentially beneficial functions to pets’ health.

**Peroxiredoxins**

A recent study[[1]](#footnote-1) analyzed a set of ageing-related genetic variants in dogs (single nucleotide polymorphisms, SNPs), we found a marginally significant association between one SNP and longevity residuals that were corrected for body weight in pedigree dog breeds in the original analysis, and also in the majority of resampled data sets. This SNP lies in a novel dog gene (ENSCAFG00000002337) that is a homolog to the human peroxiredoxin 1 (PRDX1) gene. This gene does not appear to be regularly discussed in relation to body weight, but has previously been demonstrated to be important for protection against apoptosis and oxidative stress, and the promotion of longevity in a range of organisms (Lee 2003; Olahova et al. 2008; Radyuk et al. 2009; Nystrom et al. 2012; De Haes et al. 2014).

**Superoxide dismutase (SOD) and gluthatione peroxidase (GPx) as antioxidants**

Oxidative stress is recognized a key factor in several diseases in companion animals, especially linked to aging[[2]](#footnote-2). Oxidative stress increases with age and can also be influences by factors including diet, lifestyle, physical injury or environmental conditions like pollution, noise and crowds. Two proteins enriched in caviar oil (SOD and GPx) are essential anti-oxidants and may be beneficial to counteract progressive oxidative stress.

Feeding an antioxidant blend of vitamins, minerals and carotenoids to a mixed adult dog population resulted in increased total antioxidant activity, significant reductions in both endogenous and exogenous DNA damage and higher vaccine-specific virus-neutralizing antibody levels following rabies vaccination[[3]](#footnote-3). Antioxidant supplements were also shown to significantly reduce DNA damage in cats with renal insufficiency[[4]](#footnote-4), that have a tendency to oxidative stress. Another common age-related condition in dogs is the decline of visual function, including retinal degeneration and cloudy lens (nuclear sclerosis). Antioxidant supplementation has shown potential long-term benefits for the preservation and improvement of various functions of the canine eye[[5]](#footnote-5).

Oxidative stress may also be involved in the cognitive decline that is associated with advanced age. Antioxidant diet in aged canines resulted in a significant improvement in the ability of aged but not young animals to acquire progressively more difficult learning tasks[[6]](#footnote-6),[[7]](#footnote-7). Recent laboratory studies indicate that aged cats show impairments on cognitive tasks similar to those used in dogs[[8]](#footnote-8).

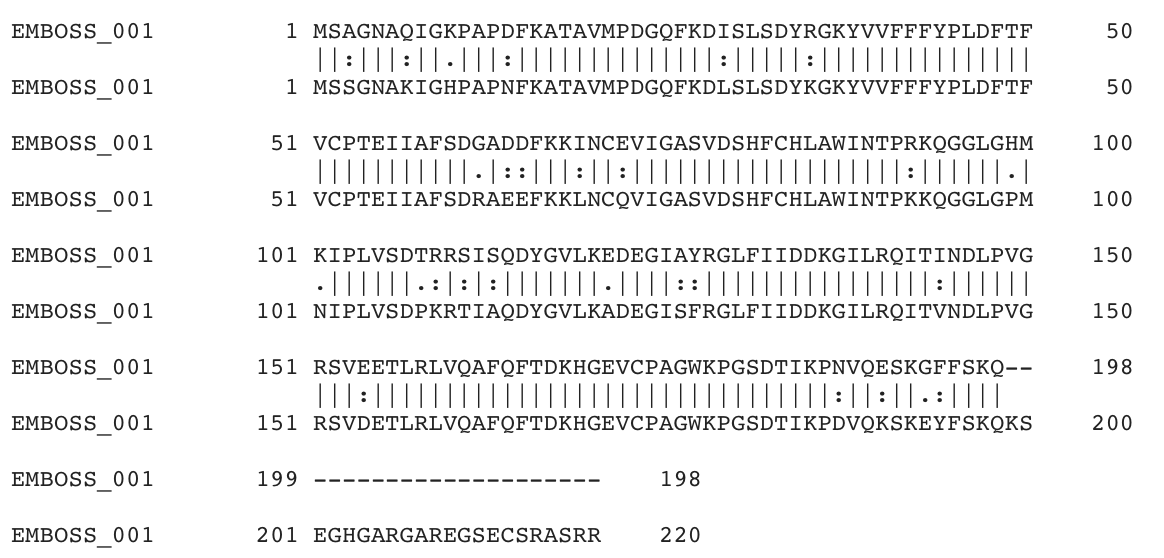
Finally, the antioxidant role of SOD and GPx were investigated in a few studies looking at dog semen cryopreservation (which has drawn a striking attraction since artificial insemination (AI) has been introduced as a powerful tool to manage dog breeding programs)[[9]](#footnote-9),[[10]](#footnote-10). The studies found that supplementing the semen samples with SOD plus GPx improved the sperm quality of both chilled and frozen‐thawed semen, particularly sperm viability and DNA integrity.

# Analysis of protein similarity

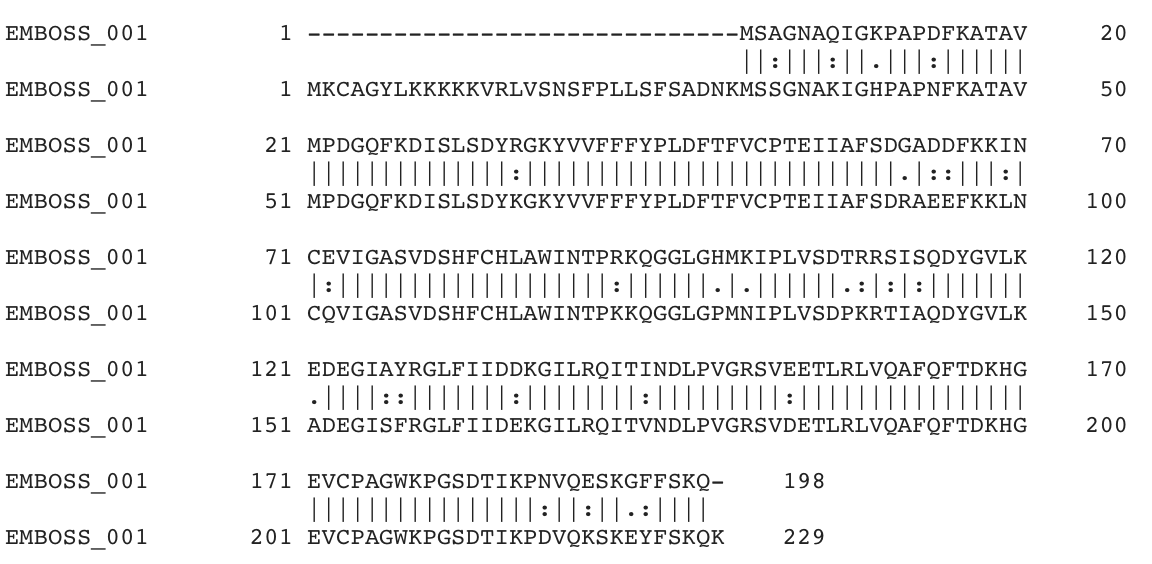
**Peroxiredoxin-1**

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| --- | --- | --- | --- |
| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A444U9U0 | 198 | 21,988 |
| *Canis lupus familiaris* | E2RHG2 | 220 | 24,323 |
| *Felis catus* | A0A2I2UZE5 | 229 | 25,523 |

Alignment of sturgeon and dog protein sequences: similarity = **86.8%**



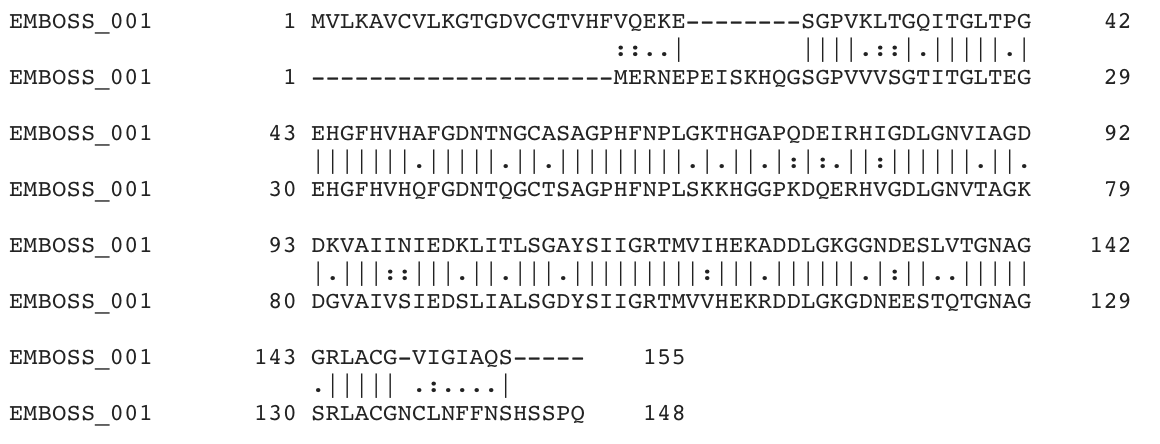
Alignment of sturgeon and cat protein sequences: similarity = **83.4%**



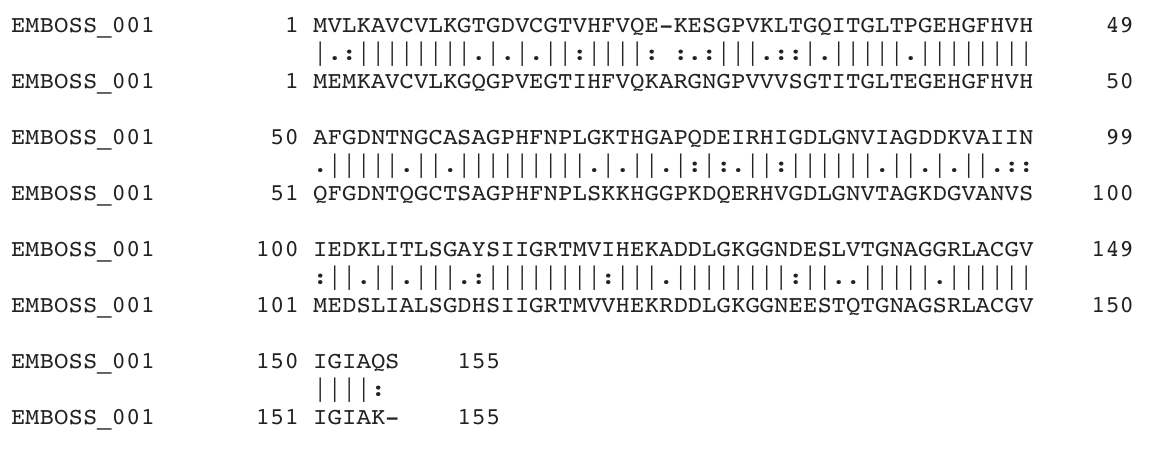
**Superoxide dismutase**

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| --- | --- | --- | --- |
| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A662YND0 | 155 | 15,890 |
| *Canis lupus familiaris* | F1Q462 | 148 | 15,606 |
| *Felis catus* | A0A2I2UPH5 | 155 | 16,033 |

Alignment of sturgeon and dog protein sequences: similarity = **62.7%**



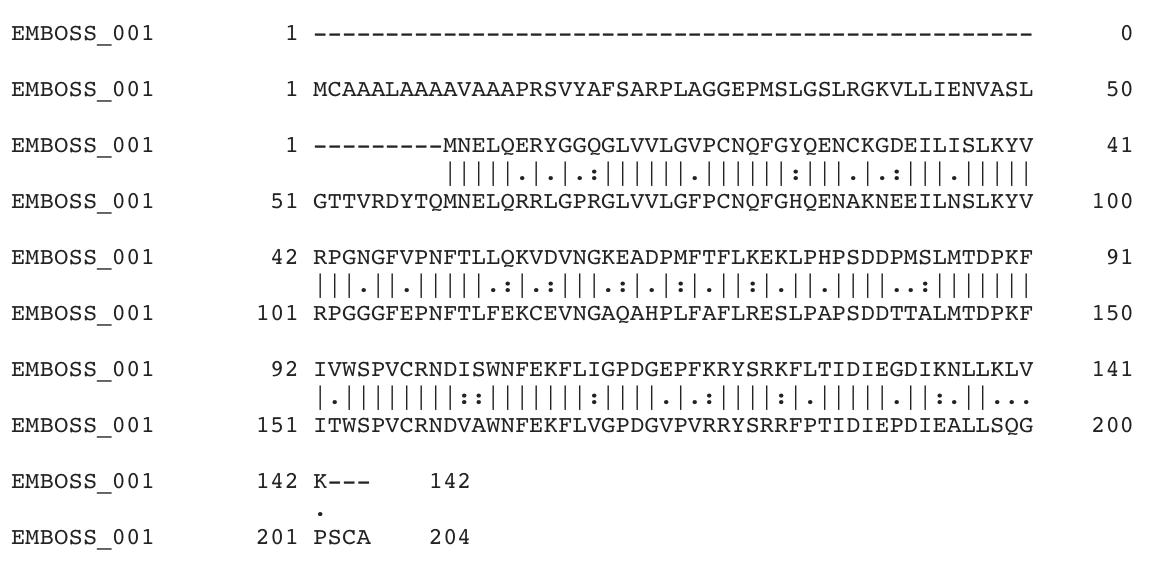
Alignment of sturgeon and cat protein sequences: similarity = **82.1%**

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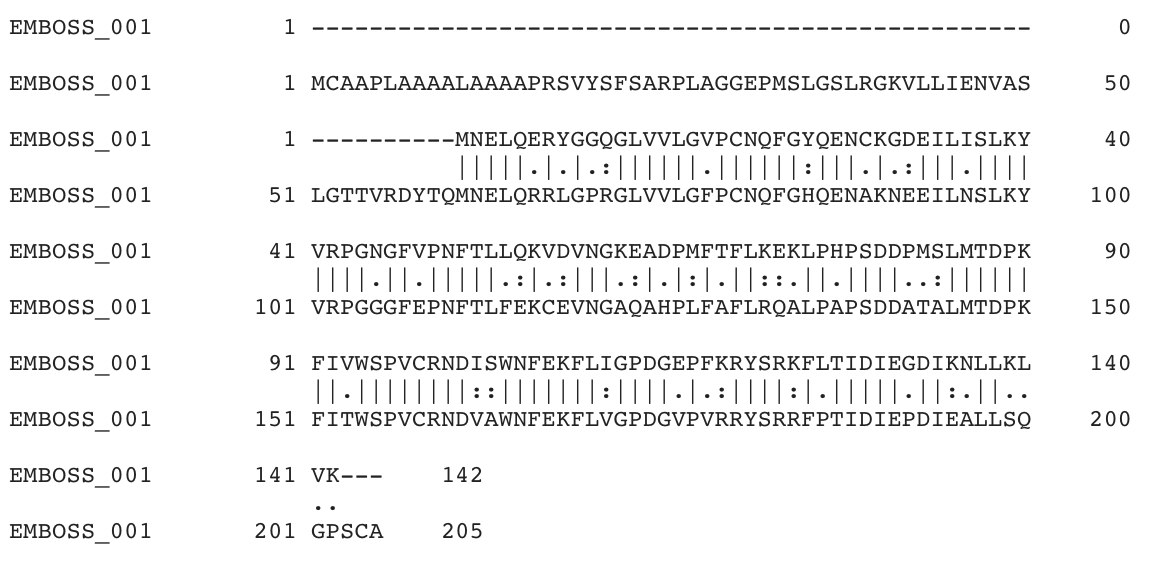
**Glutathione peroxidase**

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| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A444V5E6 | 142 | 16,259 |
| *Canis lupus familiaris* | F6XH46 | 204 | 22,185 |
| *Felis catus* | A0A2I2UII4 | 205 | 22,266 |

Alignment of sturgeon and dog protein sequences: similarity = **55.9%**



Alignment of sturgeon and cat protein sequences: similarity = **55.6 %**



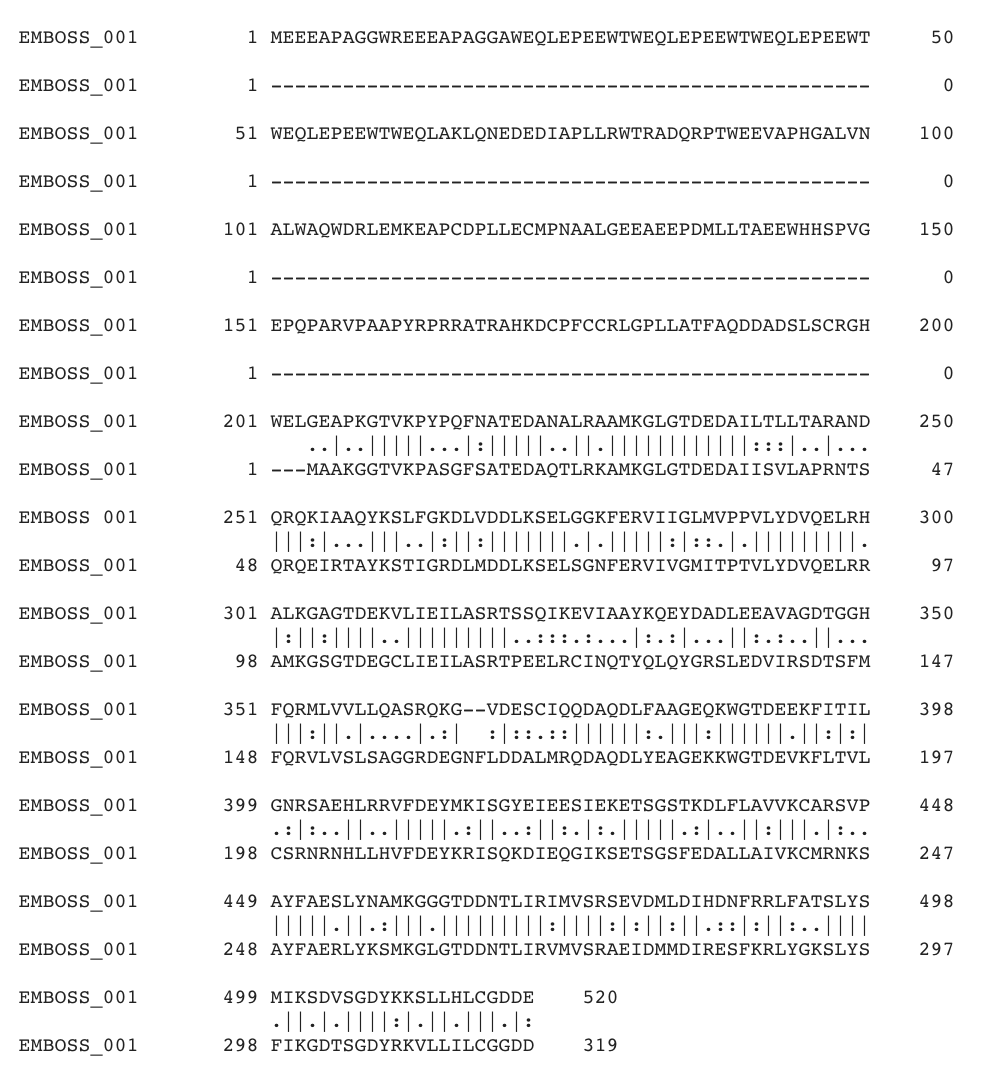
**Phosvitin**

Phosvitin is a protein enriched in eggs (including hen’s eggs). It does not have an homologous protein in the dog and cat genome but it has potential beneficial nutritional effects. In egg yolk, it is the main carrier of metals: it carries 95% of Fe3 +, for example. This has led to various studies on phosvitin, notably looking at its antioxidant properties and interfacial properties (Castellani et al., 2005; 2006).

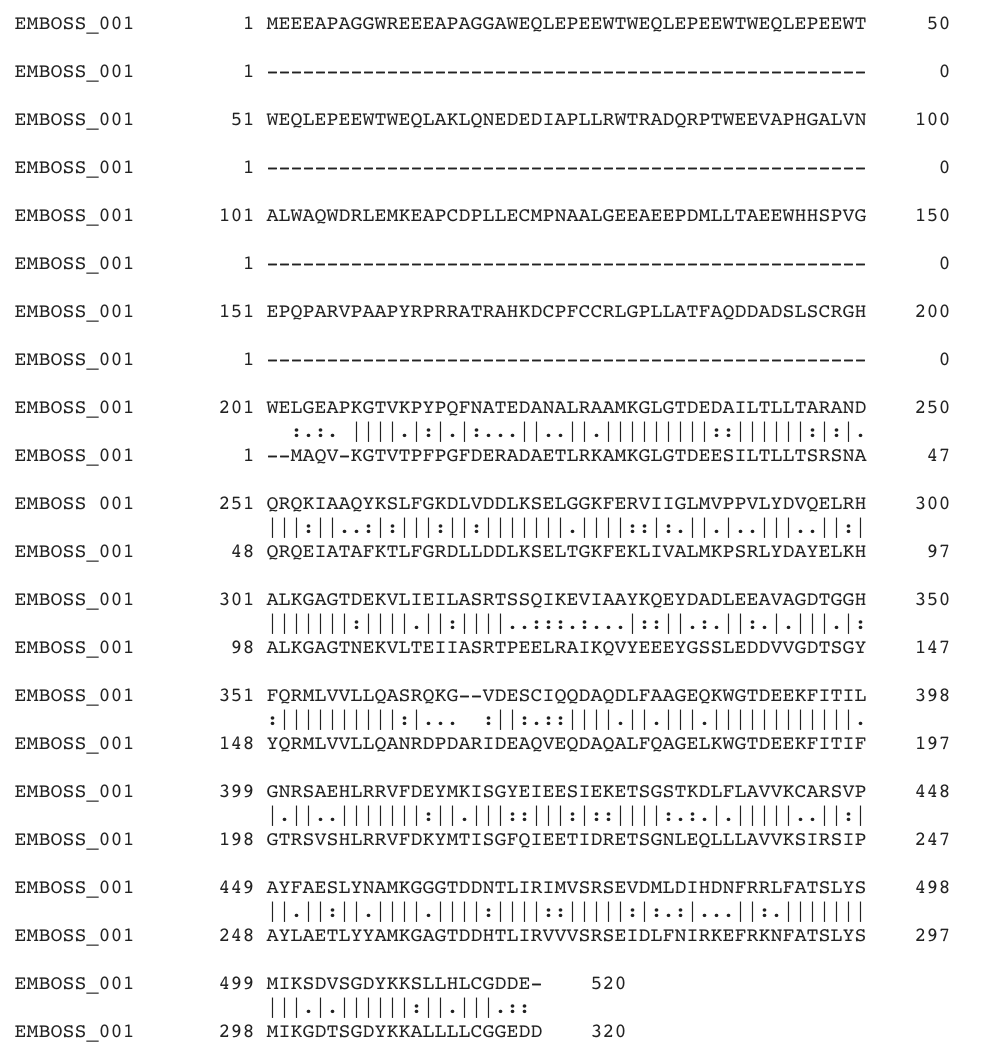
**Annexin**

|  |  |  |  |
| --- | --- | --- | --- |
| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A444UKB2 | 520 | 58,731 |
| *Canis lupus familiaris* | P50994 | 319 | 35,813 |
| *Felis catus* | M3W269 | 320 | 35,944 |

Alignment of sturgeon and dog protein sequences: similarity = **45.4%**, the first part of the protein doesn’t match.

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Alignment of sturgeon and cat protein sequences: similarity = **48.9%**

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**Perilipin-1**

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| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A444UUQ7 | 164 | 17,492 |
| *Canis lupus familiaris* | E2RQQ0 | 513 | 54,782 |
| *Felis catus* | A0A337SFV4 | 522 | 55,487 |

Alignment of sturgeon and dog protein sequences: similarity = **15%**

Alignment of sturgeon and cat protein sequences: similarity = **16.3%**

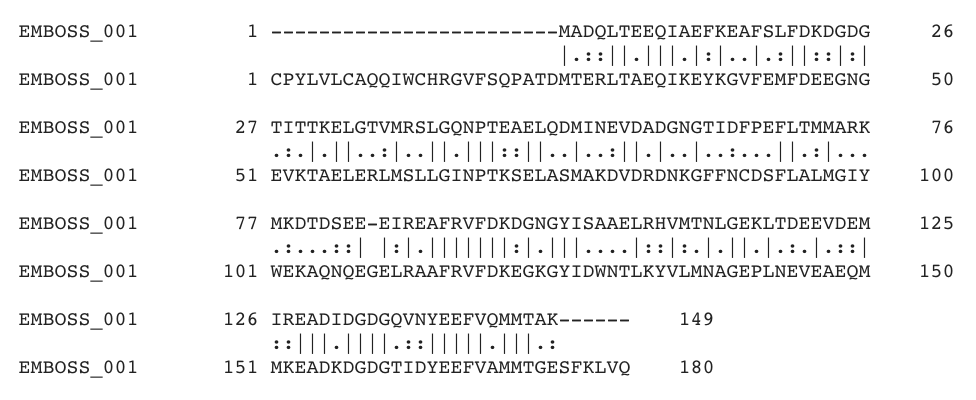
Protein is poorly conserved.

**Calmodulin**

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| --- | --- | --- | --- |
| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A444UYD9 | 149 | 16,838 |
| *Canis lupus familiaris* | E2REK6 | 149 | 16,838 |
| *Felis catus* | M3W5G8 | 180 | 20,533 |

Alignment of sturgeon and dog protein sequences: similarity = **100% -** Perfect match

Alignment of sturgeon and cat protein sequences: similarity = **55%**



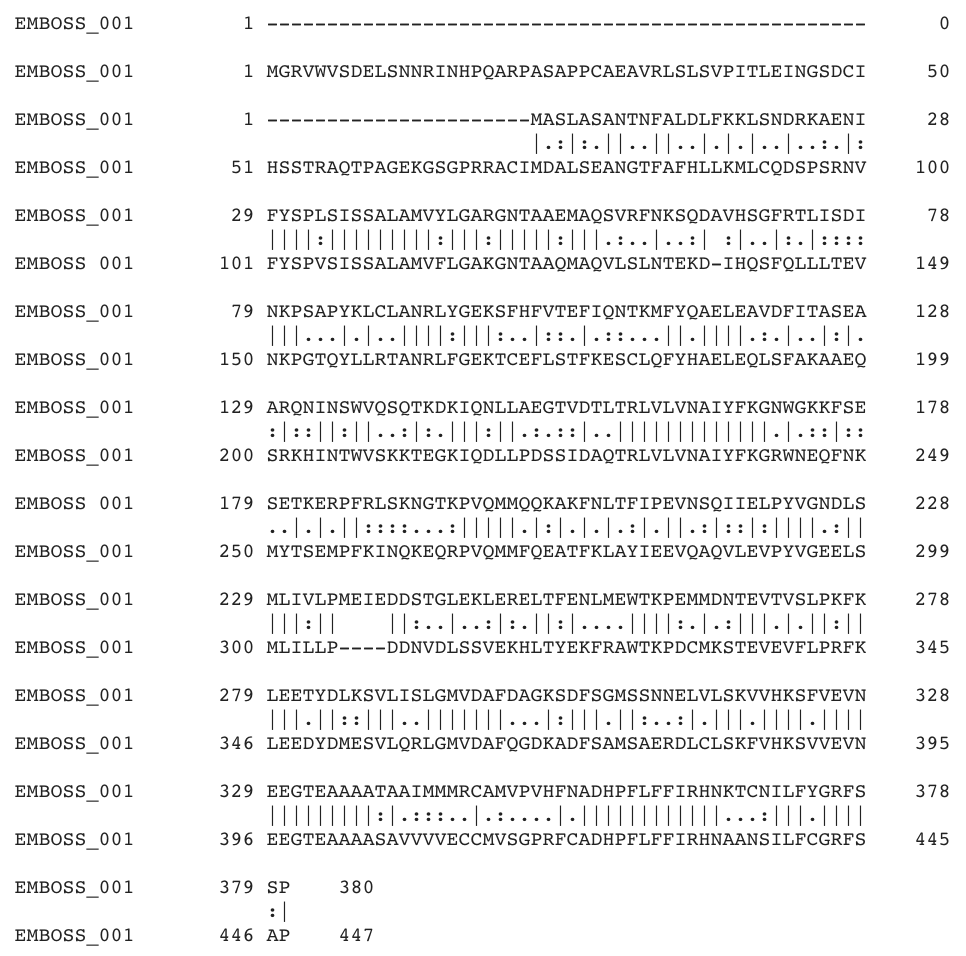
**Leukocyte elastase inhibitor**

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| --- | --- | --- | --- |
| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A444V4U3 | 380 | 42,796 |
| *Canis lupus familiaris* | F1PCE5 | 421 | 47,014 |
| *Felis catus* | M3VVF8 | 447 | 50,125 |

Alignment of sturgeon and dog protein sequences: similarity = **48.2%**

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Alignment of sturgeon and cat protein sequences: similarity = **60.6%**

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**Ferritin**

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| --- | --- | --- | --- |
| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A444U4E3 | 239 | 27,403 |
| *Canis lupus familiaris* | Q95MP7 | 245 | 27,772 |
| *Felis catus* | Q2MHN2 | 183 | 21,311 |

Alignment of sturgeon and dog protein sequences: similarity = **69.3%**

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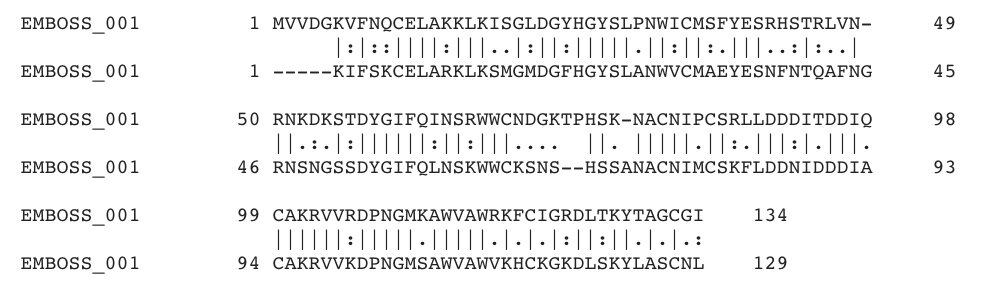
Alignment of sturgeon and cat protein sequences: similarity = **68.9%**

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**Lysozyme**

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| **Organism** | **Accession #** | **Length** | **Mass (Da)** |
| *Acipenser ruthenus* | A0A662YVW2 | 134 | 15,372 |
| *Canis lupus familiaris* | P81708 | 129 | 14,471 |
| *Felis catus* | M3W413 | 148 | 16,621 |

Alignment of sturgeon and dog protein sequences: similarity = **74.3%**

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Alignment of sturgeon and cat protein sequences: similarity = **70.3%**

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1. https://link.springer.com/article/10.1007/s00335-020-09845-1 [↑](#footnote-ref-1)
2. https://pubmed.ncbi.nlm.nih.gov/29126143/ [↑](#footnote-ref-2)
3. https://academic.oup.com/jn/article/132/6/1720S/4687748?login=true [↑](#footnote-ref-3)
4. https://link.springer.com/article/10.1007%252Fs11259-006-3269-5 [↑](#footnote-ref-4)
5. https://www.cambridge.org/core/journals/journal-of-nutritional-science/article/antioxidant-supplementation-increases-retinal-responses-and-decreases-refractive-error-changes-in-dogs/7ADA7CFCD7F70E20794EB4829FD7A35C [↑](#footnote-ref-5)
6. https://www.sciencedirect.com/science/article/abs/pii/S0197458002000738?via%3Dihub [↑](#footnote-ref-6)
7. https://www.sciencedirect.com/science/article/abs/pii/S0197458002000209?via%3Dihub [↑](#footnote-ref-7)
8. https://journals.sagepub.com/doi/full/10.1016/j.jfms.2010.09.004?casa\_token=E8RIudYfNV0AAAAA%3AUZZCrjmcxPLyuHkM54pyKxre\_mRCeu2BbcVktWoYLwjrOby6sCtelwSCqeHHEakK4t1t\_DhvgCIf [↑](#footnote-ref-8)
9. https://onlinelibrary.wiley.com/doi/full/10.1111/rda.12009 [↑](#footnote-ref-9)
10. https://synapse.koreamed.org/upload/SynapseData/PDFData/0118JVS/jvs-19-667.pdf [↑](#footnote-ref-10)