

Fatty acid-binding proteins

Overview: Fatty acid-binding proteins are chaperones for long chain fatty acids, eicosanoids, retinols, retinoic acids and related metabolites and are usually regarded as being responsible for allowing the otherwise hydrophobic ligands to be mobile in aqueous media. These binding proteins may perform functions extracellularly (e.g. in plasma) or transport these agents intracellularly; to the nucleus to interact with nuclear receptors (principally PPARs and retinoic acid receptors, see Schroeder *et al.*, 2008) or for interaction with metabolic enzymes. Although sequence homology is limited, crystallographic studies suggest conserved 3D structures across the group of binding proteins.

Fatty acid binding proteins

Nomenclature	FABP1	FABP2	FABP3
Other names	Liver FABP, L-FABP	Intestinal FABP, I-FABP, FABPI	Heart FABP, H-FABP, muscle FABP, M-FABP, mammary-derived growth inhibitor
Ensembl ID	ENSG00000163586	ENSG00000145384	ENSG00000121769
Rank order of potency	C18:0, C18:1 > C16:0, C18:2 > C20:4, C18:2 (Richieri <i>et al.</i> , 1994)	C18:0 > C16:0, C18:1 > C18:2 > C20:4, C18:3 (Richieri <i>et al.</i> , 1994)	C18:0, C18:1, C18:0 > C18:2, C18:3, C20:4 (Richieri <i>et al.</i> , 1994)

Nomenclature	FABP4	FABP5	FABP6
Other names	Adipocyte FABP, A-FABP, Adipocyte lipid-binding protein, ALBP, aP2	Epidermal FABP, E-FABP, keratinocyte FABP, KFABP, psoriasis-associated FABP, PA-FABP	Ileal FABP, gastrotropin, I-LBP, ileal bile acid transporter, I-BABP
Ensembl ID	ENSG00000170323	ENSG00000164687	ENSG00000170231
Rank order of potency	C18:1, C16:0, C18:0, C18:2 > C18:3, C20:4 (Richieri <i>et al.</i> , 1994)		

Although not tested at all FABPs, BMS309403 exhibits high affinity for FABP4 ($pIC_{50} \sim 8.8$) compared with FABP3 or FABP5 ($pIC_{50} < 6.6$, Furuhashi *et al.*, 2007; Sulsky *et al.*, 2007).

Nomenclature	FABP7	FABP8	FABP9
Other names	Brain FABP, B-FABP, brain lipid-binding protein, BLBP, mammary-derived growth inhibitor related	Myelin FABP, M-FABP, peripheral myelin protein 2, PMP2, MP2	Testis FABP, T-FABP, PERF
Ensembl ID	ENSG00000164434	ENSG00000147588	ENSG00000205186

In addition, a number of related proteins have been identified in mammalian genomes, including FABP5L2 (ENSMUSG00000062196) and FABP12 (ENSG00000197416), as well as some putative pseudogenes FABP3P2 (ENSG00000233259), FABP5L3 (ENSG00000214004) and FABP5L4 (ENSG00000229287).

Retinol-binding proteins

Nomenclature	RBP1	RBP2	RBP3
Other names	Retinol-binding protein 1, cellular retinol-binding protein I, CRBP-I	Retinol-binding protein 2, cellular retinol-binding protein II, CRBP-II	Retinol-binding protein 3, interphotoreceptor retinoid-binding protein, IRBP, interstitial retinol-binding protein
Ensembl ID	ENSG00000114115	ENSG00000114113	ENSG00000107618
Rank order of potency	–	18:0 > C16:0, C18:1, C18:2, 1:3, C20:4 (Richieri <i>et al.</i> , 2000)	–

Nomenclature	RBP4	RBP5	RBP7
Other names	Retinol-binding protein 4, plasma retinol-binding protein, PRBP	Retinol-binding protein 5, cellular retinol-binding protein III, CRBP-III, HRBPiso	Retinoid-binding protein 7, cellular retinoic acid-binding protein 4, CRABP4, CRBP4
Ensembl ID	ENSG00000138207	ENSG00000139194	ENSG00000162444

Retinaldehyde-binding protein

Nomenclature	RLBP1
Other names	Retinaldehyde-binding protein 1, cellular retinaldehyde-binding protein, CRALBP
Ensembl ID	ENSG00000140522
Rank order of potency	11- <i>cis</i> -Ral, 11- <i>cis</i> -Rol > 9- <i>cis</i> -Rol, 13- <i>cis</i> -Ral, 13- <i>cis</i> -Rol, all- <i>trans</i> -Ral, all- <i>trans</i> -Rol (Crabb <i>et al.</i> , 1998)

Retinoic acid-binding proteins

Nomenclature	CRABP1	CRABP2
Other names	Cellular retinoic acid-binding protein 1, CRABP-I	Cellular retinoic acid-binding protein 2, CRABP-II, RBP6
Ensembl ID	ENSG00000166426	ENSG00000143320
Rank order of potency	All- <i>trans</i> -RA > 9- <i>cis</i> -RA	—
	18:0 > C16:0, C18:1, C18:2, 1:3, C20:4 (Richieri <i>et al.</i> , 2000)	

Abbreviations: BMS309403, ((2'-(5-ethyl-3,4-diphenyl-1H-pyrazol-1-yl)(1,1'-biphenyl)-3-yl)oxy)-acetic acid; C16:0, palmitic acid; C18:0, stearic acid; C18:1, oleic acid; C18:2, linoleic acid; C18:3, linolenic acid; C20:4, arachidonic acid; RA, retinoic acid; Ral, retinaldehyde; Rol, retinol

Further Reading

- Chmurzynska A (2006). The multigene family of fatty acid-binding proteins (FABPs): function, structure and polymorphism. *J Appl Genet* **47**: 39–48.
- Furuhashi M, Hotamisligil GS (2008). Fatty acid-binding proteins: role in metabolic diseases and potential as drug targets. *Nat Rev Drug Discov* **7**: 489–503.
- Schroeder F, Petrescu AD, Huang H *et al.* (2008). Role of fatty acid binding proteins and long chain fatty acids in modulating nuclear receptors and gene transcription. *Lipids* **43**: 1–17.
- Storch J, Corsico B (2008). The emerging functions and mechanisms of mammalian fatty acid-binding proteins. *Annu Rev Nutr* **28**: 73–95.

References

- Crabb JW *et al.* (1998). *Protein Sci* **7**: 746–757.
- Furuhashi M *et al.* (2007). *Nature* **447**: 959–965.
- Richieri GV *et al.* (1994). *J Biol Chem* **269**: 23918–23930.
- Richieri GV *et al.* (2000). *Biochemistry* **39**: 7197–7204.
- Sulsky R *et al.* (2007). *Bioorg Med Chem Lett* **17**: 3511–3515.