

犬猫转铁蛋白受体生物信息学分析

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致谢

- 感谢**罗老师**对我们的悉心指导和谆谆教诲，让我们掌握了如何用生物信息学为自己课题服务！
- 感谢组员及同学们的支持和帮助，使我们共同进步互补短缺！

涉及到的名词中英文对照

- Canine parvovirus CPV 犬细小病毒
- Feline panleukopenia virus FPV 猫泛白细胞减少症病毒
(猫细小病毒)
- Mink enteritis virus MEV 水貂肠炎病毒 (水貂细小病毒)
- Capsid protein 2 VP2 衣壳蛋白2
- Transferrin receptor TfR 转铁蛋白受体

细小病毒分类地位

[-] Family: <i>Parvoviridae</i>	(2 Subfamilies)	← →
[-] Subfamily: <i>Densovirinae</i>	(4 Genera)	← →
[-] Subfamily: <i>Parvovirinae</i>	(5 Genera)	← →
[-] Genus: <i>Amdovirus</i>	(1 Species)	← →
[-] Genus: <i>Bocavirus</i>	(2 Species)	← →
[-] Genus: <i>Dependovirus</i>	(12 Species)	← →
[-] Genus: <i>Erythrovirus</i>	(4 Species)	← →
[-] Genus: <i>Parvovirus</i>	(12 Species)	← →
Species: <i>Chicken parvovirus</i>		← →
Species: <i>Feline panleukopenia virus</i>		← →
Species: <i>H-1 parvovirus</i>		← →
Species: <i>HB parvovirus</i>		← →
Species: <i>Kilham rat virus</i>		← →
Species: <i>Lapine parvovirus</i>		← →
Species: <i>LuIII virus</i>		← →

MEV引起水貂肠炎



CPV引起犬的心肌炎和肠炎



FPV引起猫的白细胞减少综合症



转铁蛋白受体 (TfR)

- TfR 是一种 II 型跨膜糖蛋白，是由两个同源二聚体的亚基通过两条二硫键交联而成。每个单体(含 760 个氨基酸，分子量为 90~95 kDa)包含一个大的胞外 C 端区域(671 个氨基酸)，一个单跨膜区域(包含 28 氨基酸)及一个短的 N 端区域(包含 61 氨基酸)。C 端区域是一个外功能区，它包含 Tf 的结合位点。外功能区包含 3 个 N-糖基化位点及一个 O-糖基化位点，这些位点的糖基化作用是 TfR 功能所必需的。

TfR 作用：参与铁离子的代谢，一些病毒的受体

意义

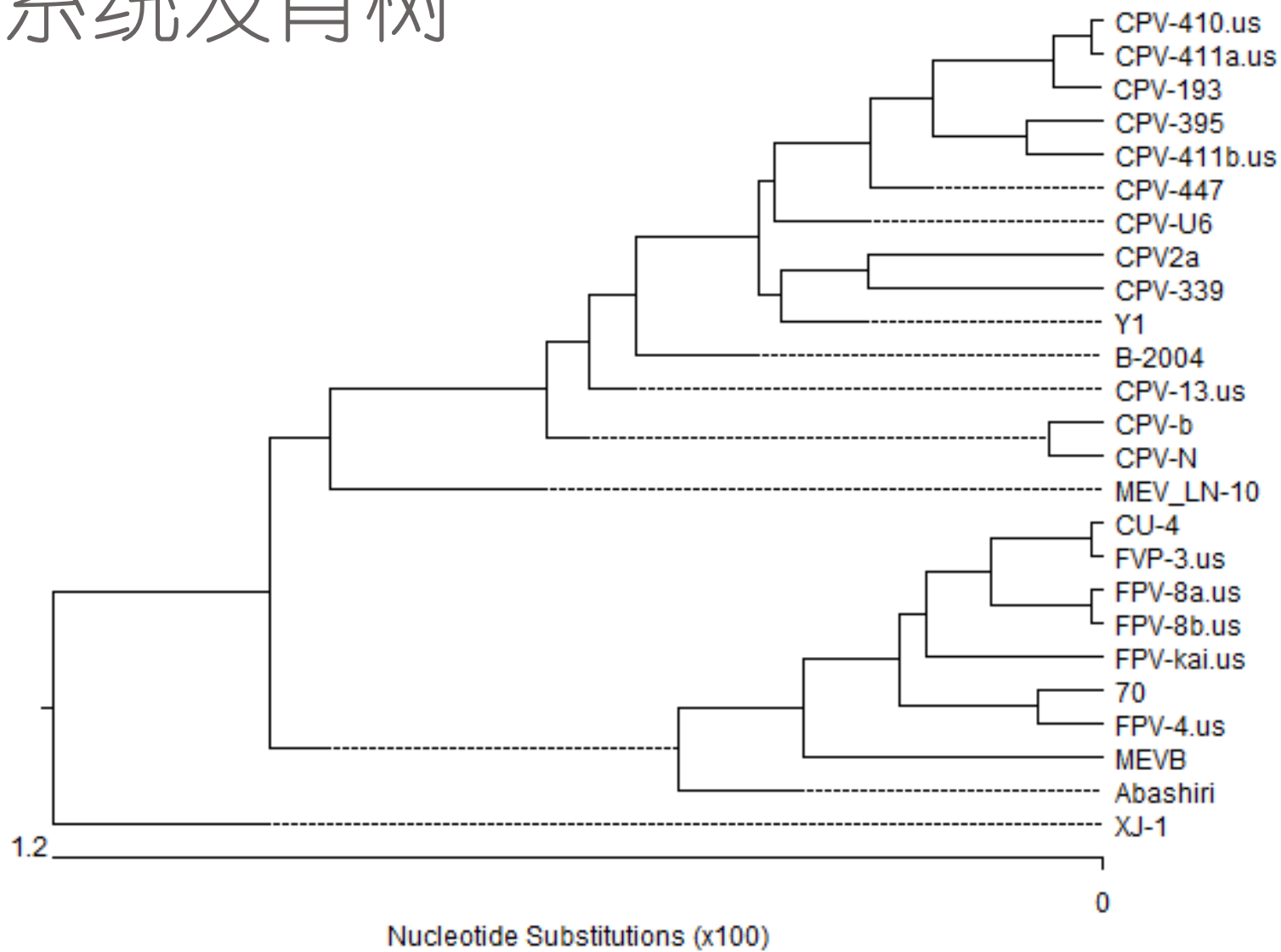
- TfR是CPV、FPV和MEV结合的受体
- 依据VP2 与TfR 结合区域的空间结构设计小分子有机化合物来封阻结合位点
- 基础研究

肉食性细小病毒核苷酸序列相似性

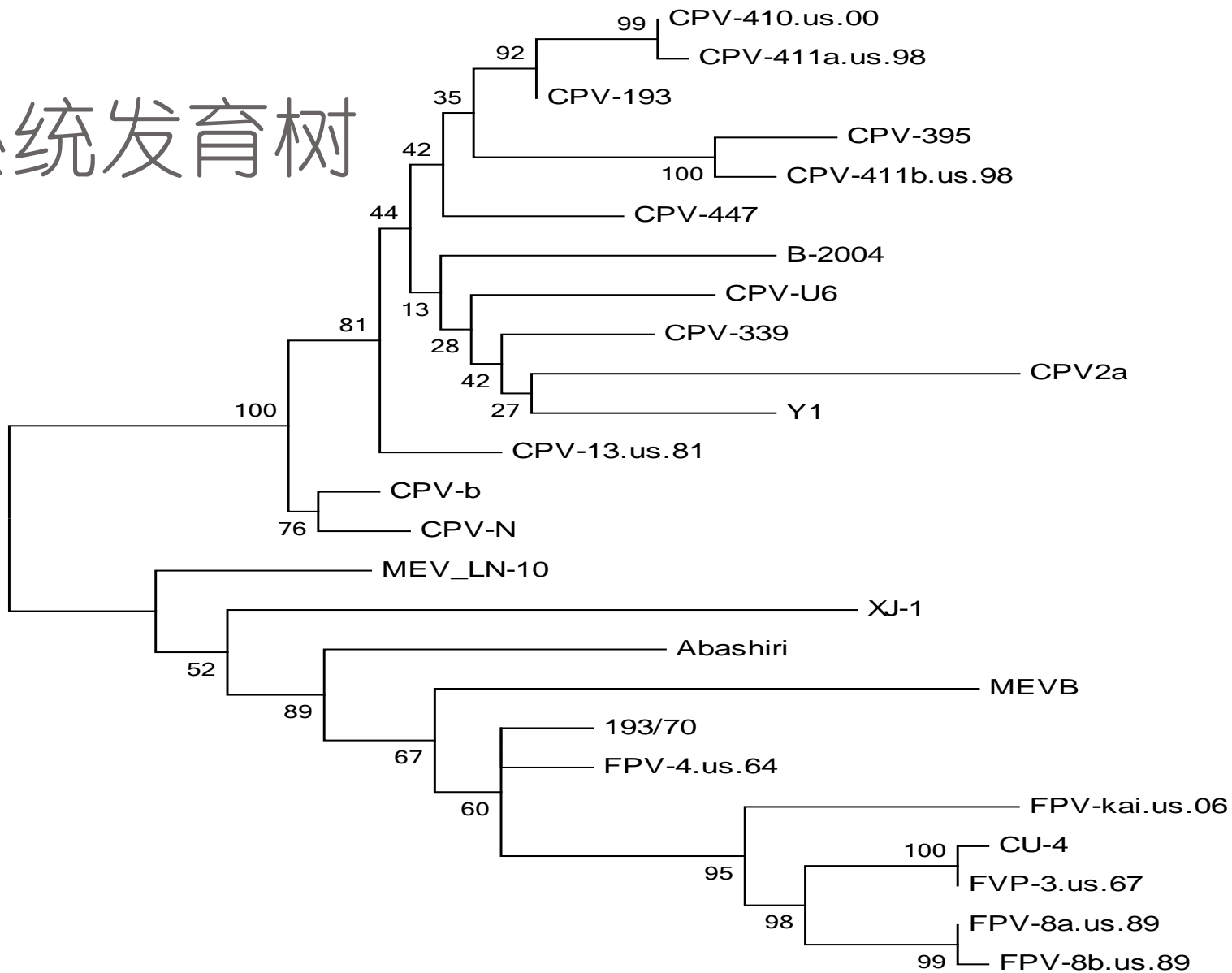
		Percent Identity																										
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
Divergence	1	█	99.3	99.0	98.8	99.2	99.2	99.1	98.9	99.1	99.0	99.0	99.2	99.4	99.3	99.1	99.6	99.9	99.6	99.6	99.5	99.6	99.5	99.0	99.1	99.5	1	70
	2	0.7	█	98.9	98.7	99.0	99.0	98.9	98.8	98.9	98.9	98.8	99.0	99.1	99.1	98.9	99.0	99.3	99.0	99.0	99.1	99.0	99.2	98.4	98.9	99.3	2	XJ-1
	3	1.0	1.1	█	99.3	99.6	99.6	99.6	99.4	99.5	99.5	99.4	99.6	99.6	99.5	99.5	98.8	99.0	98.8	98.8	98.9	98.8	99.0	98.2	99.5	99.2	3	B-2004
	4	1.2	1.3	0.7	█	99.4	99.5	99.5	99.3	99.4	99.4	99.3	99.4	99.4	99.3	99.4	98.5	98.8	98.5	98.5	98.6	98.5	98.8	98.0	99.4	99.0	4	CPV2a
	5	0.8	1.0	0.4	0.6	█	99.8	99.7	99.6	99.7	99.7	99.6	99.7	99.8	99.7	99.6	99.0	99.2	99.0	99.0	99.1	99.0	99.2	98.5	99.7	99.4	5	CPV-13.us
	6	0.8	1.0	0.4	0.5	0.2	█	99.7	99.7	99.9	99.9	99.7	99.8	99.7	99.7	99.7	98.9	99.2	98.9	98.9	99.0	98.9	99.2	98.4	99.7	99.3	6	CPV-193
	7	0.9	1.1	0.4	0.5	0.3	0.3	█	99.5	99.6	99.6	99.5	99.6	99.6	99.6	99.7	98.8	99.1	98.8	98.8	98.9	98.8	99.1	98.3	99.7	99.3	7	CPV-339
	8	1.1	1.2	0.6	0.7	0.4	0.3	0.5	█	99.6	99.6	99.8	99.6	99.5	99.5	99.5	98.7	98.9	98.7	98.7	98.8	98.7	98.9	98.1	99.5	99.1	8	CPV-395
	9	0.9	1.1	0.5	0.6	0.3	0.1	0.4	0.4	█	100.0	99.6	99.7	99.6	99.6	99.6	98.8	99.1	98.8	98.8	98.9	98.8	99.1	98.3	99.6	99.3	9	CPV-410.us
	10	1.0	1.1	0.5	0.6	0.3	0.1	0.4	0.4	0.0	█	99.6	99.7	99.6	99.6	99.6	98.8	99.0	98.8	98.8	98.9	98.8	99.0	98.3	99.6	99.2	10	CPV-411a.us
	11	1.0	1.2	0.6	0.7	0.4	0.3	0.5	0.2	0.4	0.4	█	99.6	99.5	99.5	99.5	98.7	98.9	98.7	98.7	98.8	98.7	98.9	98.2	99.5	99.1	11	CPV-411b.us
	12	0.8	1.0	0.4	0.6	0.3	0.2	0.4	0.4	0.3	0.3	0.4	█	99.7	99.6	99.7	98.9	99.2	98.9	98.9	99.0	98.9	99.2	98.4	99.6	99.3	12	CPV-447
	13	0.6	0.9	0.4	0.6	0.2	0.3	0.4	0.5	0.4	0.4	0.5	0.3	█	99.9	99.6	99.1	99.3	99.1	99.1	99.2	99.1	99.3	98.6	99.6	99.4	13	CPV-b
	14	0.7	0.9	0.5	0.7	0.3	0.3	0.4	0.5	0.4	0.4	0.5	0.4	0.1	█	99.6	99.0	99.3	99.0	99.0	99.1	99.0	99.3	98.5	99.6	99.4	14	CPV-N
	15	0.9	1.1	0.5	0.6	0.4	0.3	0.3	0.5	0.4	0.4	0.5	0.3	0.4	0.4	█	98.8	99.1	98.8	98.8	98.9	98.8	99.1	98.4	99.6	99.2	15	CPV-U6
	16	0.4	1.0	1.3	1.5	1.0	1.1	1.2	1.4	1.2	1.2	1.3	1.1	0.9	1.0	1.2	█	99.6	99.7	99.8	99.6	100.0	99.3	98.7	98.8	99.3	16	CU-4
	17	0.1	0.7	1.0	1.2	0.8	0.8	0.9	1.1	0.9	1.0	1.1	0.8	0.7	0.8	0.9	0.4	█	99.6	99.6	99.5	99.6	99.5	98.9	99.1	99.5	17	FPV-4.us
	18	0.4	1.0	1.2	1.5	1.0	1.1	1.2	1.3	1.2	1.2	1.3	1.1	0.9	1.0	1.2	0.3	0.4	█	100.0	99.6	99.8	99.3	98.6	98.8	99.3	18	FPV-8a.us
	19	0.4	1.0	1.3	1.5	1.0	1.1	1.2	1.4	1.2	1.2	1.3	1.1	0.9	1.0	1.2	0.2	0.4	0.0	█	99.6	99.7	99.3	98.7	98.8	99.3	19	FPV-8b.us
	20	0.5	0.9	1.1	1.4	0.9	1.0	1.1	1.2	1.1	1.1	1.2	1.0	0.8	0.9	1.1	0.4	0.5	0.4	0.4	█	99.6	99.3	98.7	98.9	99.3	20	FPV-kai.us
	21	0.4	1.0	1.2	1.5	1.0	1.1	1.2	1.3	1.2	1.2	1.3	1.1	0.9	1.0	1.2	0.0	0.4	0.2	0.3	0.4	█	99.3	98.6	98.8	99.3	21	FVP-3.us
	22	0.5	0.8	1.0	1.2	0.8	0.8	0.9	1.1	0.9	1.0	1.1	0.8	0.7	0.8	0.9	0.7	0.5	0.7	0.7	0.7	0.7	█	98.8	99.1	99.5	22	Abashiri
	23	0.5	1.0	1.2	1.5	1.0	1.1	1.2	1.3	1.2	1.2	1.3	1.1	0.9	1.0	1.1	0.8	0.5	0.8	0.8	0.8	0.8	0.6	█	98.3	98.7	23	MEVB
	24	0.9	1.1	0.5	0.6	0.3	0.3	0.3	0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.4	1.2	0.9	1.2	1.2	1.1	1.2	0.9	1.2	█	99.3	24	Y1
	25	0.5	0.7	0.8	1.0	0.6	0.7	0.8	0.9	0.8	0.8	0.9	0.7	0.6	0.6	0.8	0.8	0.5	0.7	0.8	0.7	0.7	0.5	0.8	0.8	█	25	MEV_LN-10
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25			

Fig.1 CPV, FPV和MEV 核苷酸序列相似性

系统发育树



系统发育树




0.001

人、犬和猫TfR蛋白序列比对

Identical positions	577
Identity	74.935%
Similar positions	133
Program	clustalo

Annotation [Customize](#)

	Entry	Entry name	Protein names 	Organism	Gene names
<input checked="" type="checkbox"/>	P02786	TFR1_HUMAN	Transferrin receptor protein 1	Homo sapiens (Human)	TFRC
<input checked="" type="checkbox"/>	Q9GLD3	TFR1_CANFA	Transferrin receptor protein 1	Canis familiaris (Dog) (Canis lupus familiaris)	TFRC
<input checked="" type="checkbox"/>	Q9MYZ3	TFR1_FELCA	Transferrin receptor protein 1	Felis catus (Cat) (Felis silvestris catus)	TFRC

人、犬和猫TfR蛋白序列进化树构建



0.2

核酸序列比对

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1 -----ATGATGGATCAAGCCAG 17 gi|57163844|ref|NM_001009312.1|
1 -----ATGATGGATCAAGCCAG 17 gi|50978811|ref|NM_001003111.1|
241 GCGCCTCGAGCGGCTGCAGGTTCTTCTGTGTGGCAGTTCAGAATGATGGATCAAGCTAG 300 gi|189458816|ref|NM_003234.2|
***** **

18 ATCAGCATTCTCTACCTTGTGGTGGAGAACCATTGTCCTATACCCGGTTTGTAGTCTGGC 77 gi|57163844|ref|NM_001009312.1|
18 ATCAGCATTCTCTACCTTGTGGTGGAGAACCATTGTCCTATACCCGGTTTGTAGTCTGGC 77 gi|50978811|ref|NM_001003111.1|
301 ATCAGCATTCTCTAACCTTGTGGTGGAGAACCATTGTCATATACCCGGTTCAGCCTGGC 360 gi|189458816|ref|NM_003234.2|
*****.*****.***** ** *****

78 TCGGCAAGTAGATGGTGACAACAGTCATGTGGAGATGAAACTAGCTGCAGATGAAGAAGA 137 gi|57163844|ref|NM_001009312.1|
78 ACGGCAAGTAGATGGTGATAACAGCCATGTGGAGATGAAACTAGCTGCAGATGAAGAAGA 137 gi|50978811|ref|NM_001003111.1|
361 TCGGCAAGTAGATGGCGATAACAGTCATGTGGAGATGAAACTTGTGTAGATGAAGAAGA 420 gi|189458816|ref|NM_003234.2|
:***** ** *****:***** *****

138 AAATGTTGACAATAACATGAGGGATAATGGTGCCAGTGTCCAAAACCAAAAAGGTTTAA 197 gi|57163844|ref|NM_001009312.1|
138 AAATGTTGACAATAACATGAGGGTAATCATGCCAGTGTCCAAAACCAAAAAGGTGTAA 197 gi|50978811|ref|NM_001003111.1|
421 AAATGCTGACAATAACACAAA-----GGCCAATGTCCAAAACCAAAAAGGTGTAG 471 gi|189458816|ref|NM_003234.2|
**** ***** .*. ****.****.***** **

198 TGGATTTATCTGCTATGGGACTATCGCTATAATCCTCTTTTTCTTGATTGGATTTATGAT 257 gi|57163844|ref|NM_001009312.1|
198 TGGATTTATCTGCTATGGGACTATTGCTGTAGTCCTCTTTTTCTTGATTGGATTTATGAT 257 gi|50978811|ref|NM_001003111.1|
472 TGAAGTATCTGCTATGGGACTATTGCTGTGATCGTCTTTTTCTTGATTGGATTTATGAT 531 gi|189458816|ref|NM_003234.2|

2115 TTTCCGACATATCTTTTGGGGCACTGGCTCTCACACTCTGTCAGCATTACTAGAGCATCT 2174 gi|57163844|ref|NM_001009312.1|
2118 TTTCCGTCATATCTTCTGGGGTCTGGCTCTCACACTCTGCCAGCTTTAGTGGAGCATT 2177 gi|50978811|ref|NM_001003111.1|
2371 TTTCCGACATGTCTTCTGGGGCTCCGGCTCTCACACGCTGCCAGCTTTACTGGAGAACT 2430 gi|189458816|ref|NM_003234.2|
*****:***.**** ***** :* ***** ** *****:*** *.***.*

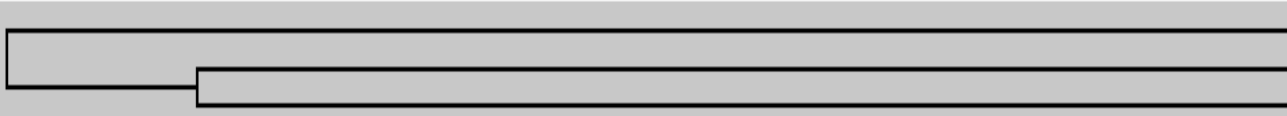
2175 GAAGCTGCGCCAGGAAAACATCAGTGCTTTTAATGAAACACTGTTTAGAAAACAGTTGGC 2234 gi|57163844|ref|NM_001009312.1|
2178 GAAGCTGCGTCAGAAAAATAAGAGTGCTTTTAATGAAACACTGTTGAGAAAACAGTTGGC 2237 gi|50978811|ref|NM_001003111.1|
2431 GAAACTGCGTAAACAAAATAACGGTGCTTTTAATGAAACGCTGTTTCAGAAAACAGTTGGC 2490 gi|189458816|ref|NM_003234.2|
****.*****.***.*****:*.*****.***** ***** *****

2235 TCTAACAACTTGGACTATTTCAGGGGGCTGCAAATGCCCTCTCTGGTGACATTTGGGATAT 2294 gi|57163844|ref|NM_001009312.1|
2238 TCTAGCAACTTGGACCATTCAAGGAGCTGCAAATGCCCTCTCTGGTGACATATGGGATAT 2297 gi|50978811|ref|NM_001003111.1|
2491 TCTAGCTACTTGGACTATTTCAGGGAGCTGCAAATGCCCTCTCTGGTGACGTTTGGGACAT 2550 gi|189458816|ref|NM_003234.2|
****.*:***** *****.***.*****.*****.***:***** **

2295 TGACAATGAGTTTTAA----- 2310 gi|57163844|ref|NM_001009312.1|
2298 TGACAATGAGTTTTAA----- 2313 gi|50978811|ref|NM_001003111.1|
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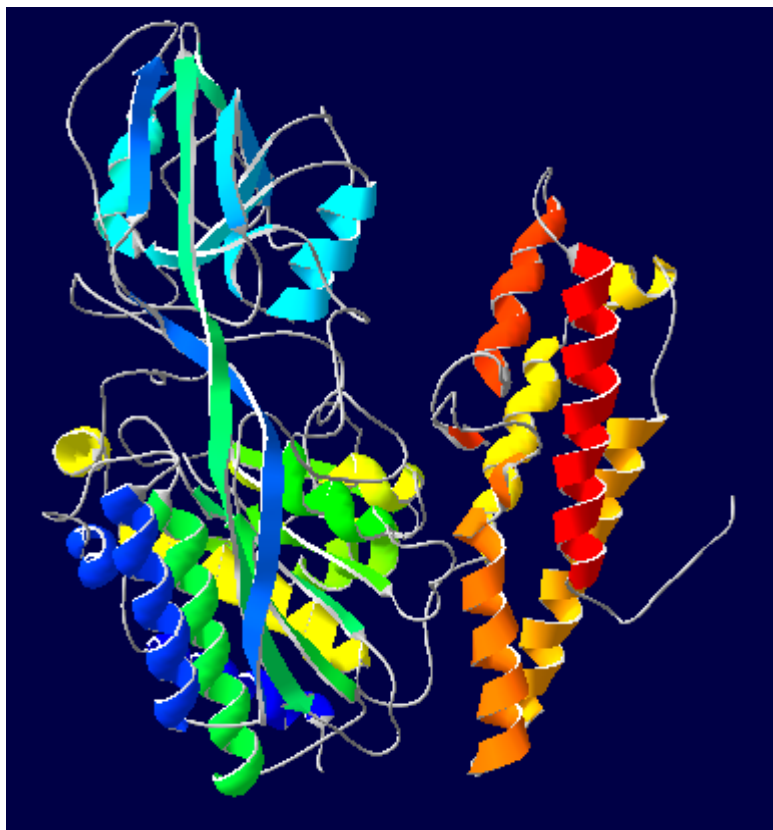
人、猫和犬TfR核酸序列比对

Identity	35.439%
Similar positions	227
Program	clustalo

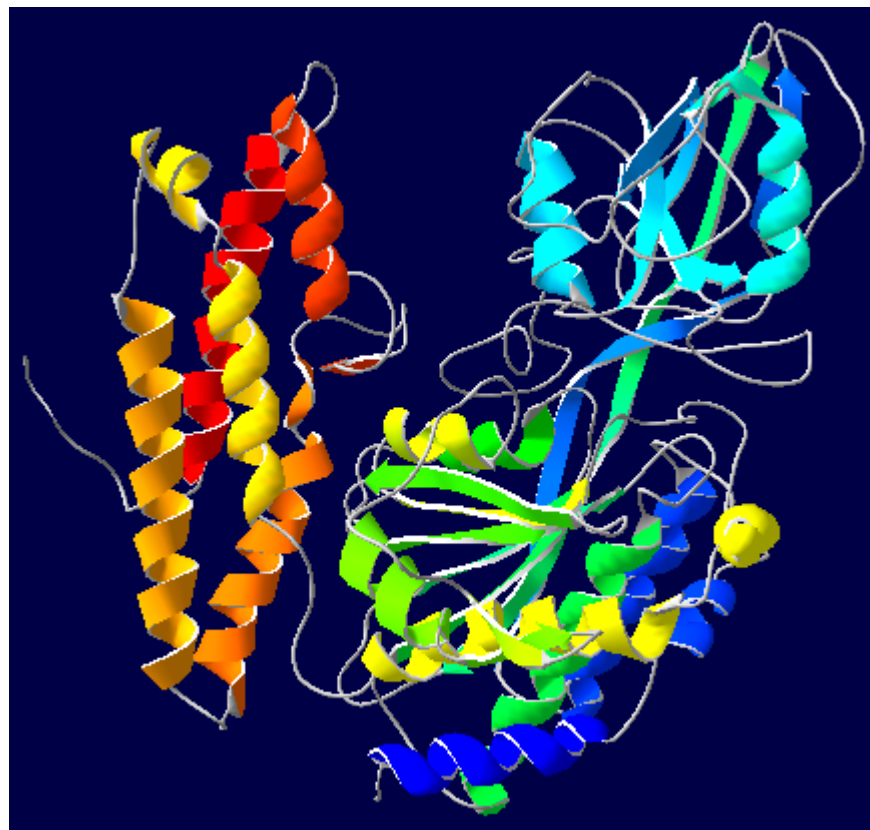


gi|50978811|ref|NM_001003111.1|
gi|57163844|ref|NM_001009312.1|
gi|189458816|ref|NM_003234.2|

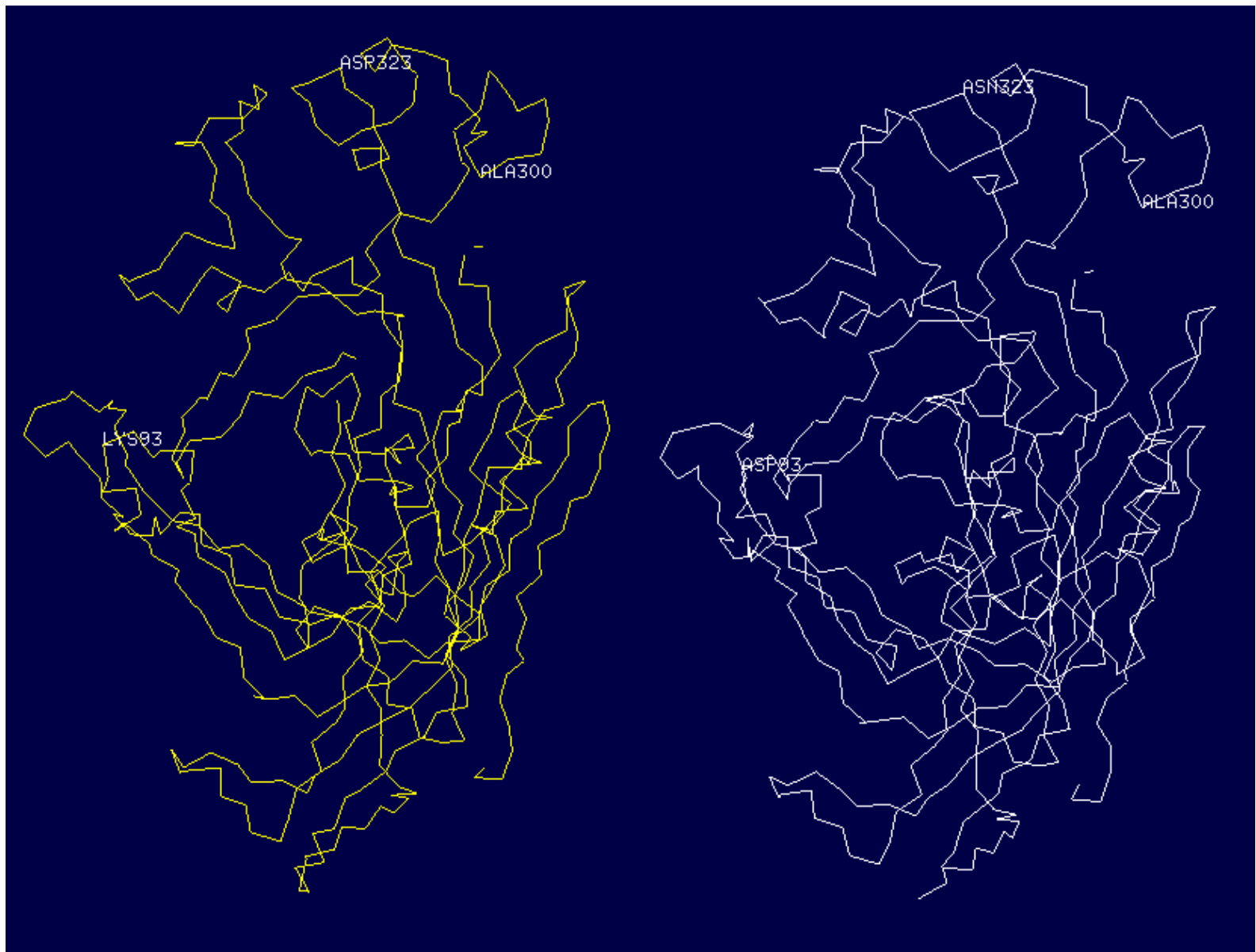
犬猫TfR3D结构预测



Cat TfR



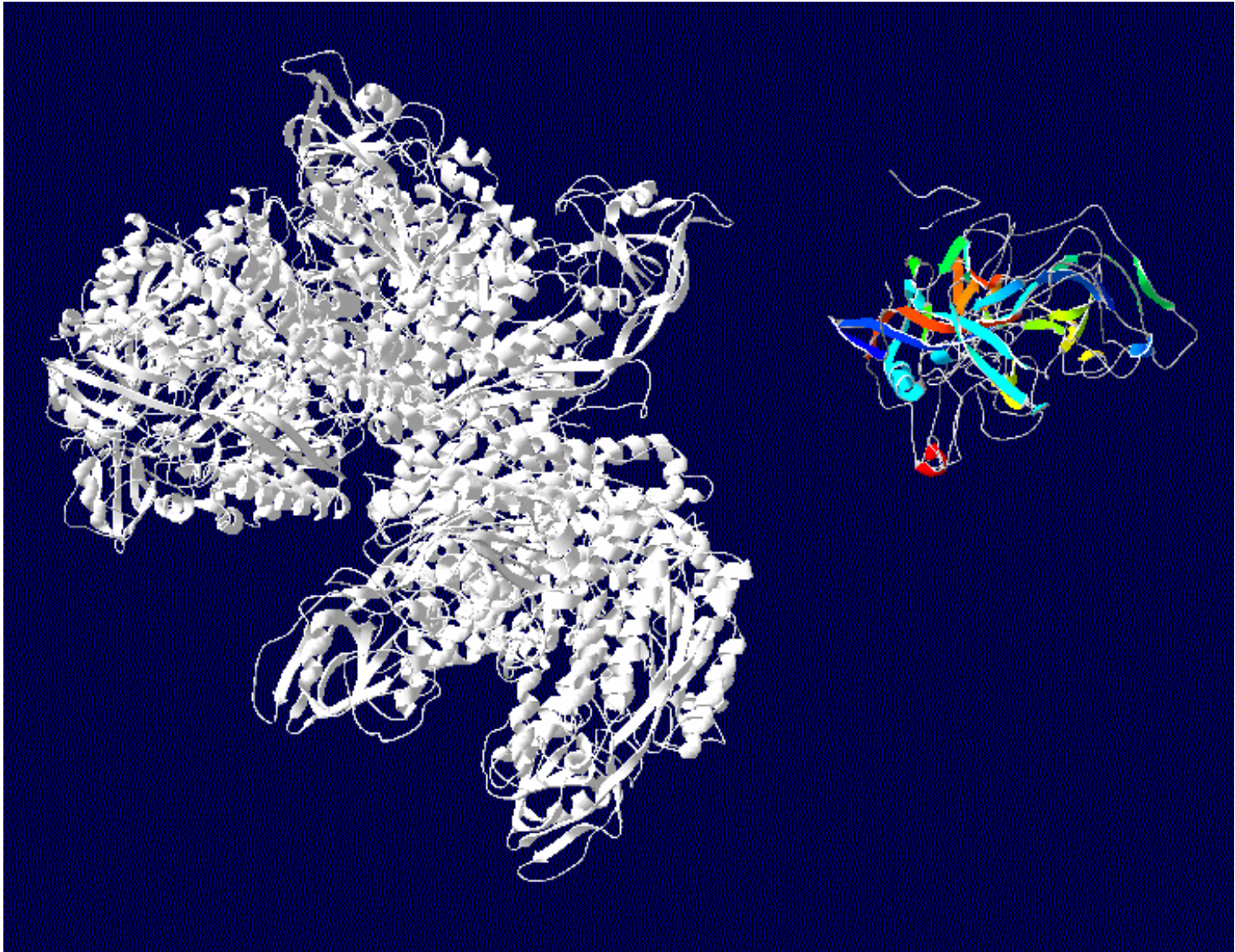
Dog TfR



FPV VP2

CPV VP2

VP2与TfR结合方式



Thank you !