

拟南芥油菜素内酯受体蛋白激酶 (AtBRI1)结构预测和功能分析

小组成员：崔晓玉 黄锁 孟令志，
张强

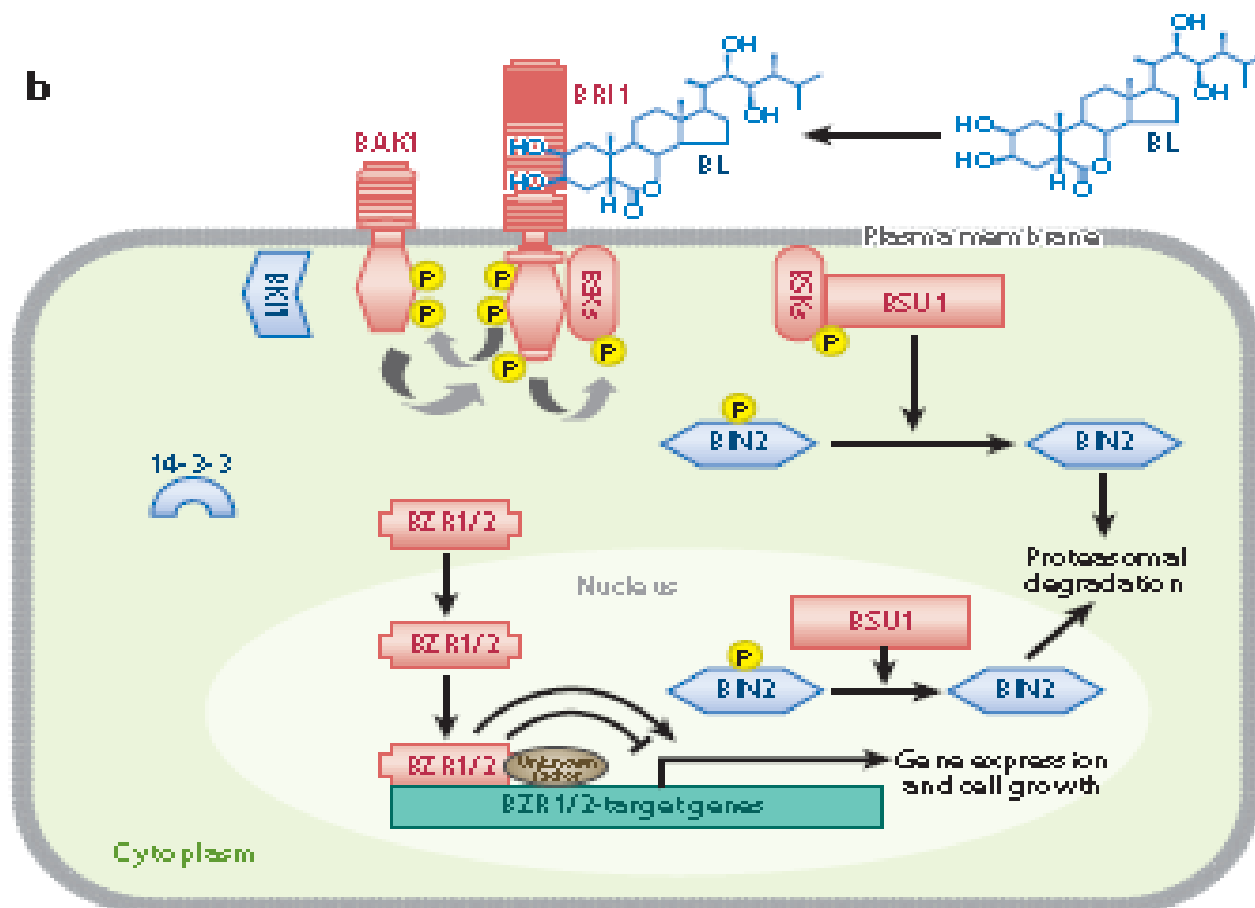
研究背景：

- 油菜素内酯是是“第六大植物激素”，1970年首次在油菜花粉中发现，该物质本身又是一种甾醇类化合物，所以命名为“油菜素内酯”
- 油菜素内酯参与调节众多植物生长发育的过程，在植物的种子休眠与萌发、器官分化、维管组织发育、开花和衰老及对生物胁迫和非生物胁迫等各重要过程中起到重要调控作用。近年来，植物体内油菜素内酯的生物合成和信号传递机制的研究激发了了众多生物学家和育种专家的兴趣。

油菜素内酯信号传递机制：

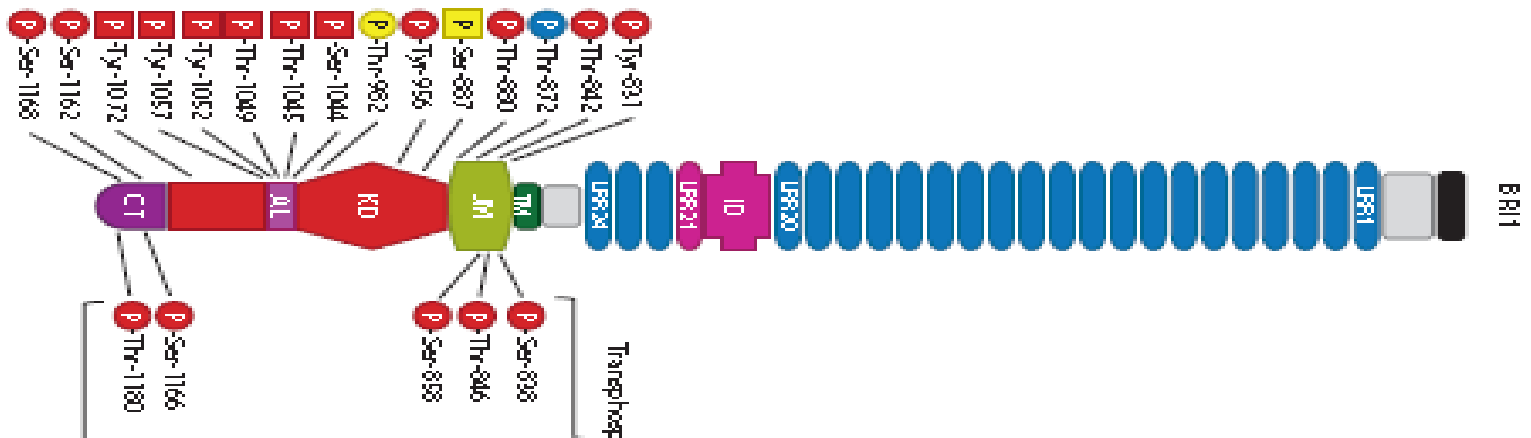
- 油菜素内酯与油菜素内酯受体蛋白激酶 (BRI1) 胞外结构域相互作用，引发BRI1胞内酪氨酸发生自磷酸化反应, 激酶区获得催化活性磷酸化下游的BSKs, BSKs磷酸化BSU1, BSU1磷酸化引发细胞核内BES1\BZR1大量积累，调节BRs合成基因和信号响应基因的表达。

油菜素内酯信号传递机制图解：

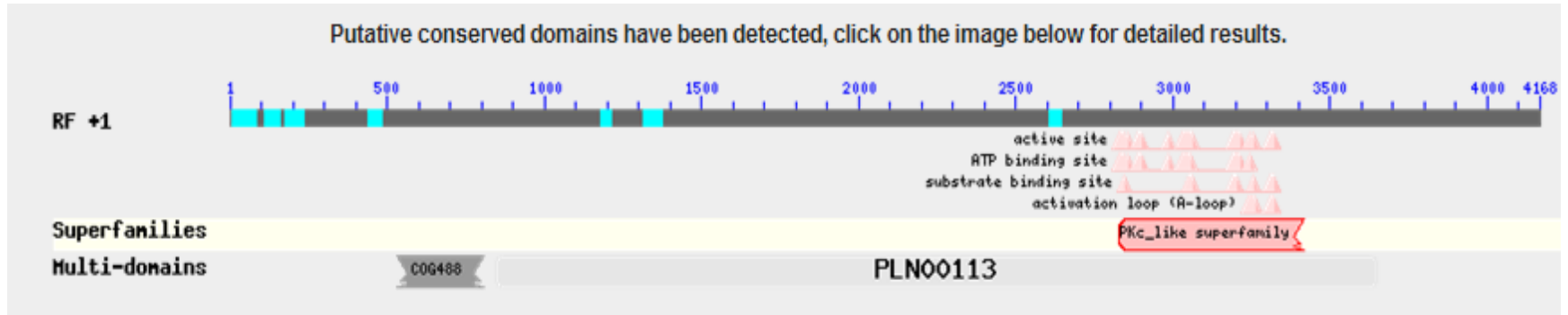


拟南芥油菜素内酯受体蛋白激酶AtBRI1:

BRI1是一种双特异性蛋白激酶，既有Ser/Thr蛋白激酶活性，又有Tyr蛋白激酶活性。序列全长1196aa,定位于细胞膜，是一种跨膜蛋白。结构上分为LRR-rich结构域，岛屿区域，近膜端和鸟苷酰基环化酶区域。

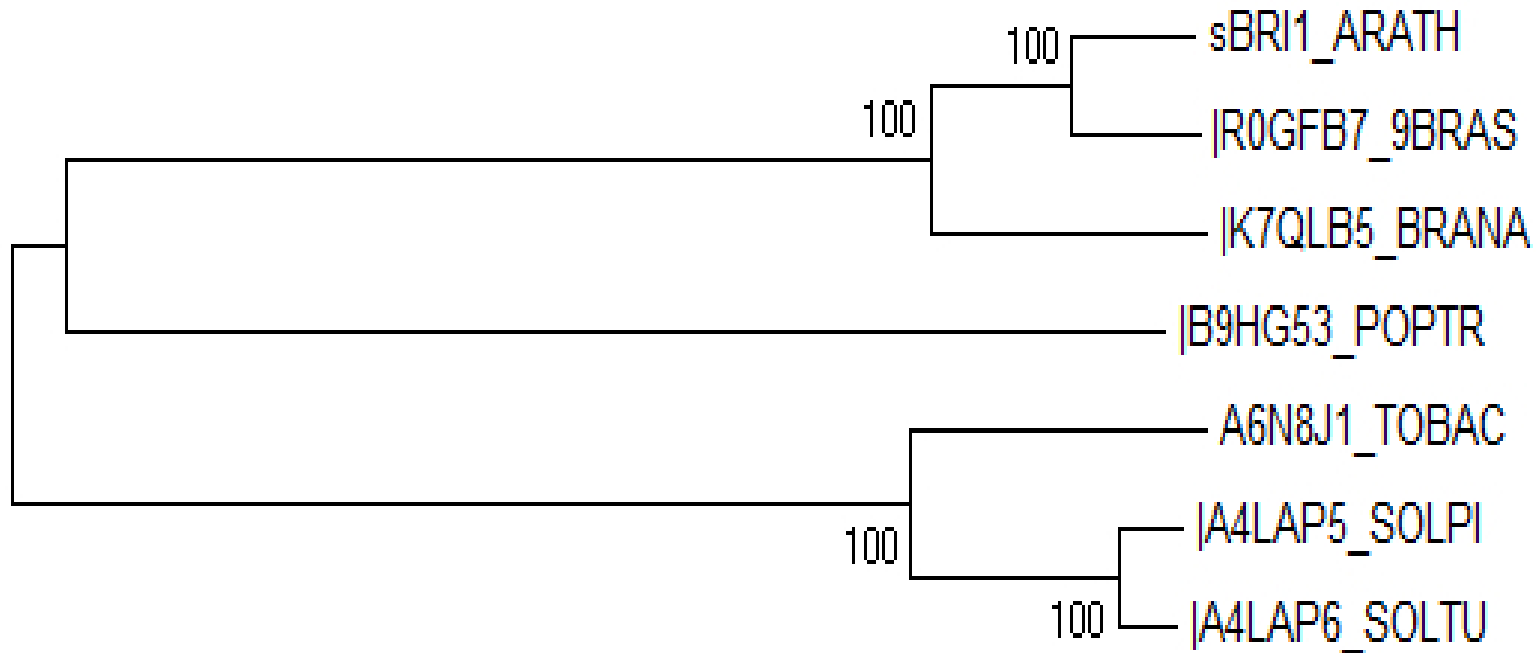


NCBI进行BLAST:



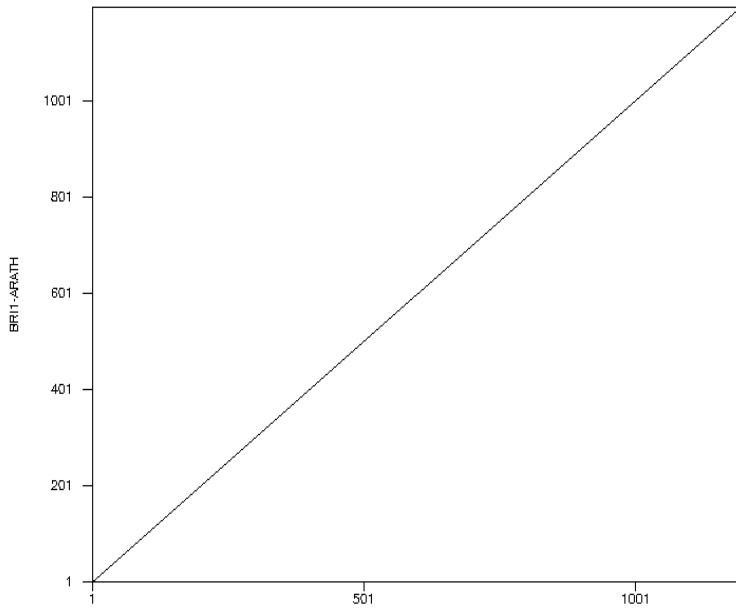
RecName: Full=Protein BRASSINOSTEROID INSENSITIVE 1; Short=AtBRI1; AltName: Full=Brassinosteroid LRR receptor kinase; Flags: Precursor	2250	2250	84%	0.0	100%	Q22476.1
RecName: Full=Systemin receptor SR160; AltName: Full=Brassinosteroid LRR receptor kinase; Flags: Precursor	1447	1447	83%	0.0	66%	Q8L899.1
RecName: Full=Brassinosteroid LRR receptor kinase; AltName: Full=Altered brassinolide sensitivity 1; AltName: Full=Systemin receptor SR160; AltName: Full=tBRI1; Flag	1444	1444	83%	0.0	66%	Q8GUQ5.1
RecName: Full=Serine/threonine-protein kinase BRI1-like 1; AltName: Full=BRASSINOSTEROID INSENSITIVE 1-like protein 1; Flags: Precursor	937	937	81%	0.0	49%	Q9ZWC8.1
RecName: Full=Receptor-like protein kinase BRI1-like 3; AltName: Full=BRASSINOSTEROID INSENSITIVE 1-like protein 3; Flags: Precursor	932	932	75%	0.0	50%	Q9LJF3.1
RecName: Full=Serine/threonine-protein kinase BRI1-like 2; AltName: Full=BRASSINOSTEROID INSENSITIVE 1-like protein 2; AltName: Full=Protein VASCULAR HIGHWA	868	1075	81%	0.0	50%	Q9ZPS9.1

进化树分析

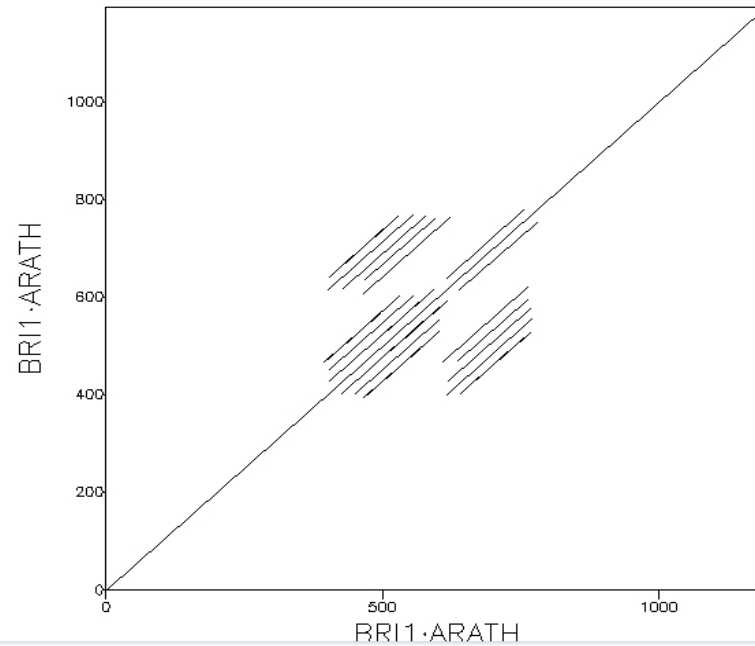


Dotup 和 Dotmatcher 序列内重复序列比对

Dotup: fasta::6973:BR11·ARATH vs fasta::6974:BR11·ARATH
Fri 10 Jan 2014 21:36:25



Dotmatcher: fasta::6988:BR11·ARATH vs fasta::6989:BR11·A...
(windowsize = 100, threshold = 100.00 10/01/14)



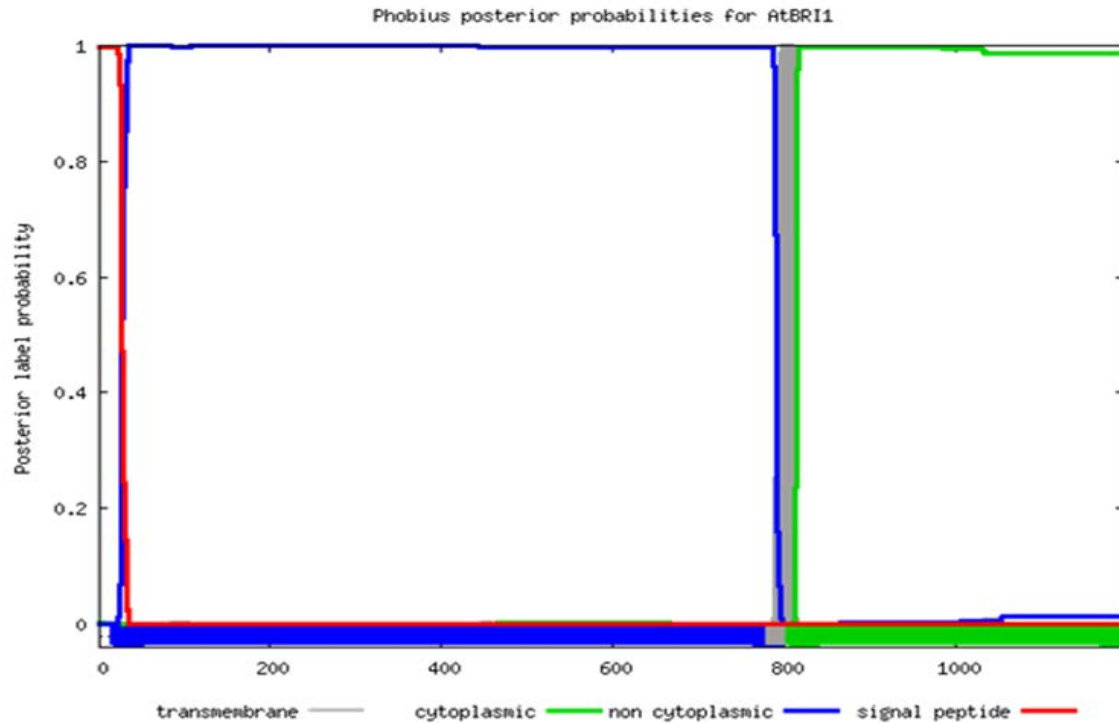
SMART 分析AtBRI1氨基酸序列:

Confidently predicted domains, repeats, motifs and features:

Name	Start ▲	End	E-value
transmembrane region	7	29	N/A
LRR	98	120	215
LRR	172	202	89.8
LRR	290	314	84.9
low complexity	338	349	N/A
LRR	364	388	49.8
LRR	487	511	162
LRR	535	559	47.1
LRR	701	725	38.7
transmembrane region	792	814	N/A
low complexity	815	827	N/A
STYKc	883	1155	7e-37

Click on a row to highlight the feature in the diagram above. Click the feature name for more information.

Phobius信号肽预测和结构分析:



Prediction of AtBRI1

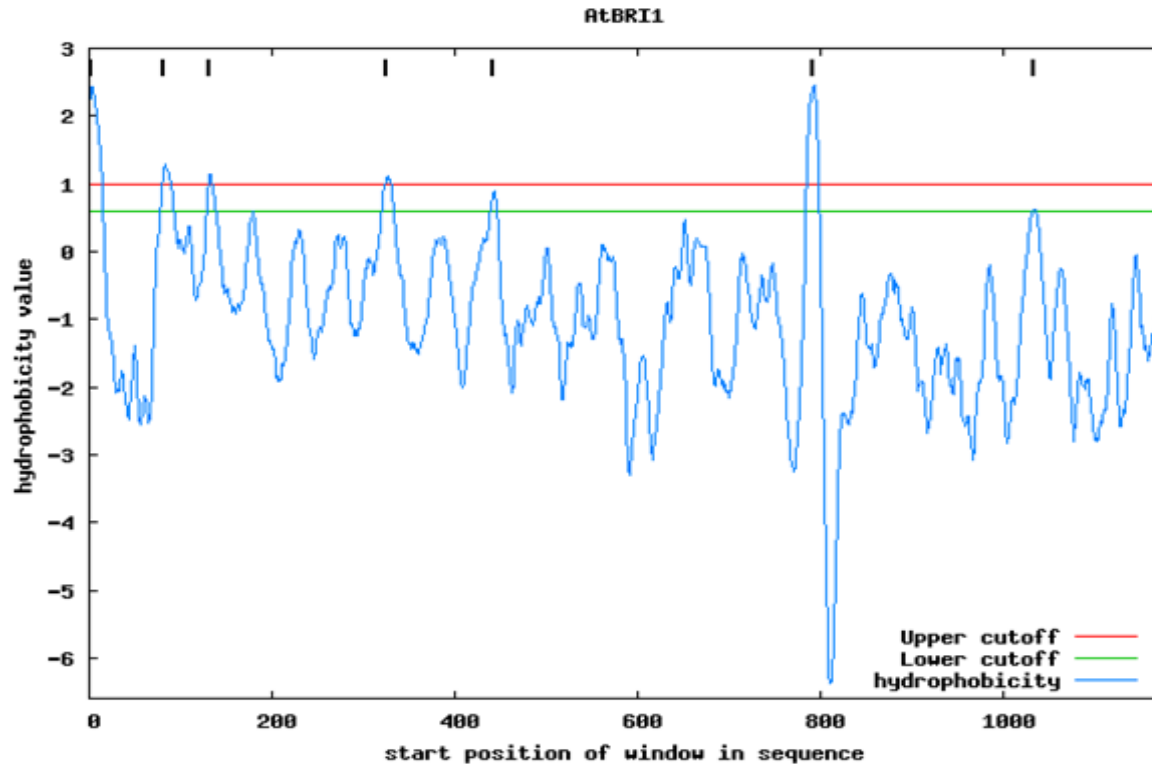
ID	AtBRI1			
FT	SIGNAL	1	25	
FT	REGION	1	6	N-REGION.
FT	REGION	7	20	H-REGION.
FT	REGION	21	25	C-REGION.
FT	TOPO_DOM	26	791	NON CYTOPLASMIC.
FT	TRANSMEM	792	814	
FT	TOPO_DOM	815	1196	CYTOPLASMIC.

NetAcet 豆蔻酰化位点预测:

```
#  
# NetAcet 1.0 prediction results, 1 sequence  
#  
#  
# Sequence          #      Context   Score   Acetylation  
# -----  
AtBRI1             3 T   -MKTFFS   0.488   .
```

[Explain](#) the output. Go [back](#).

Toppred跨膜螺旋预测:

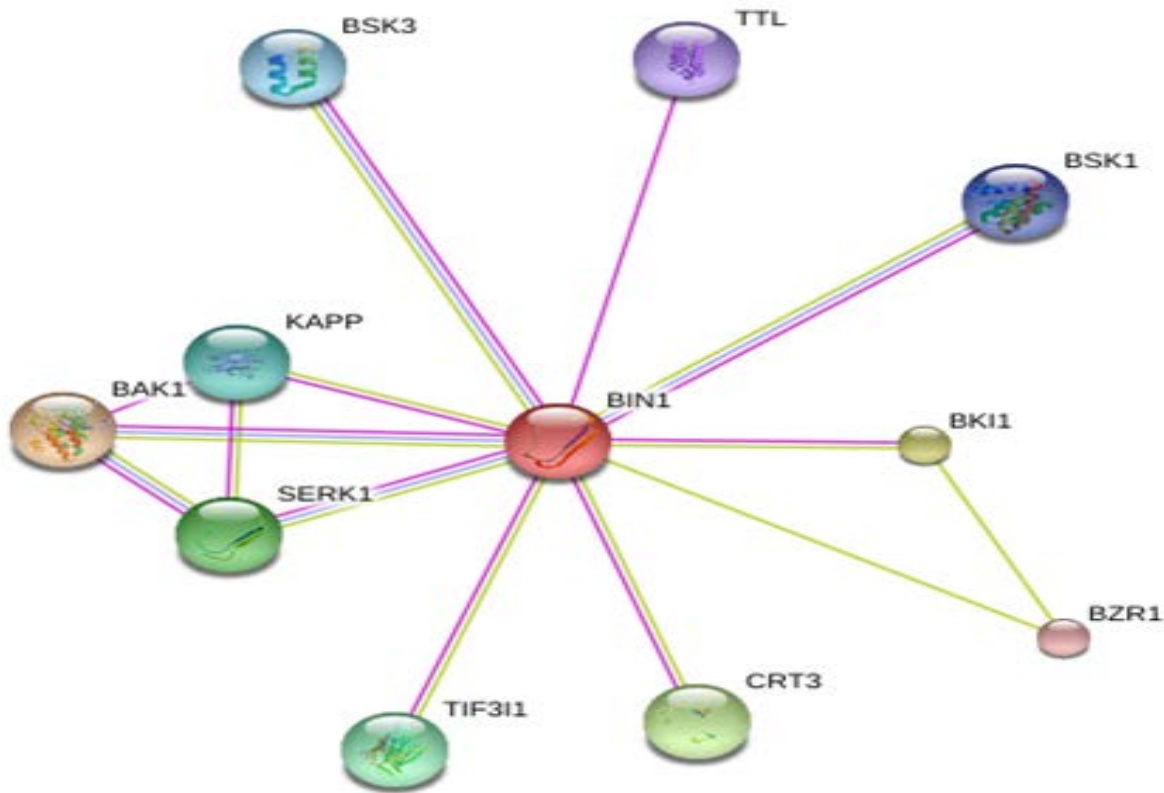


Fri Jan 10 15:42:31 2014

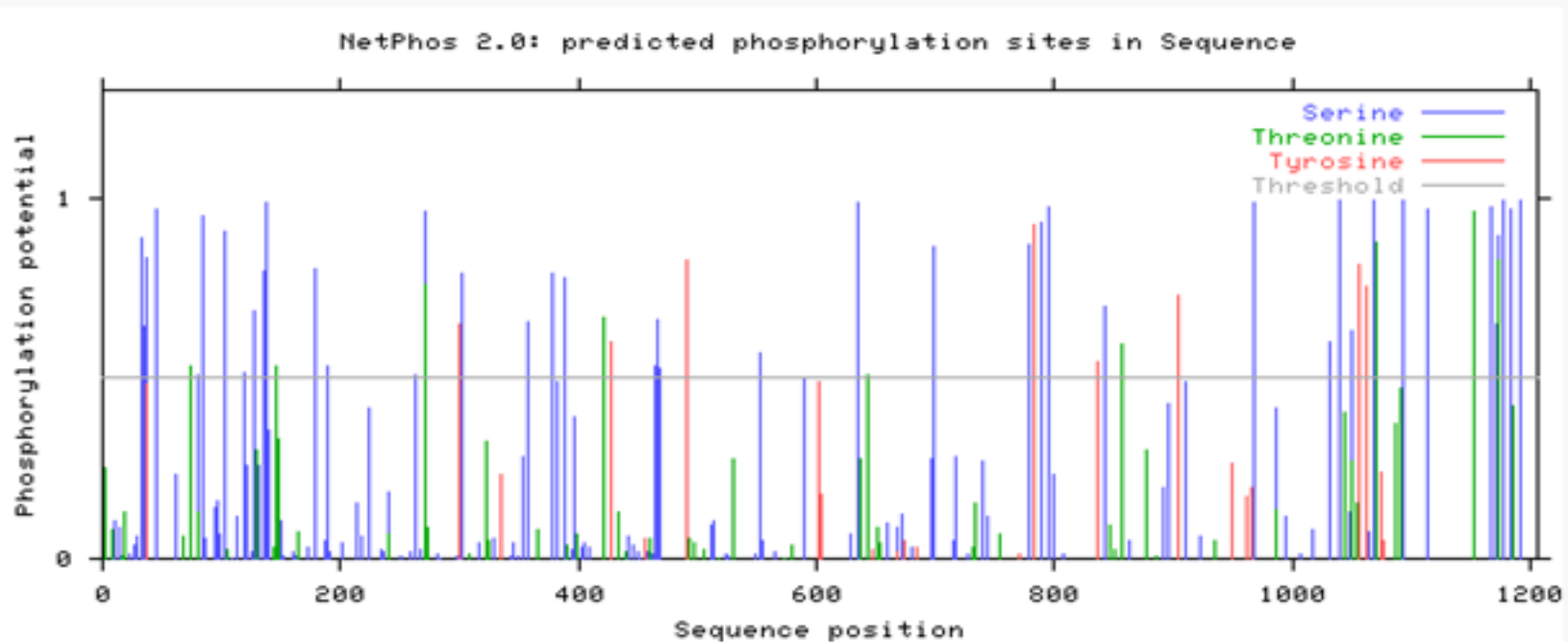
Candidate membrane-spanning segments:

Helix	Begin	End	Score	Certainty
1	4	24	2.435	Certain
2	83	103	1.300	Certain
3	133	153	1.152	Certain
4	327	347	1.109	Certain
5	444	464	0.883	Putative
6	794	814	2.462	Certain
7	1035	1055	0.623	Putative

与BRI1相互作用的蛋白：



NetPhos 磷酸化位点预测:

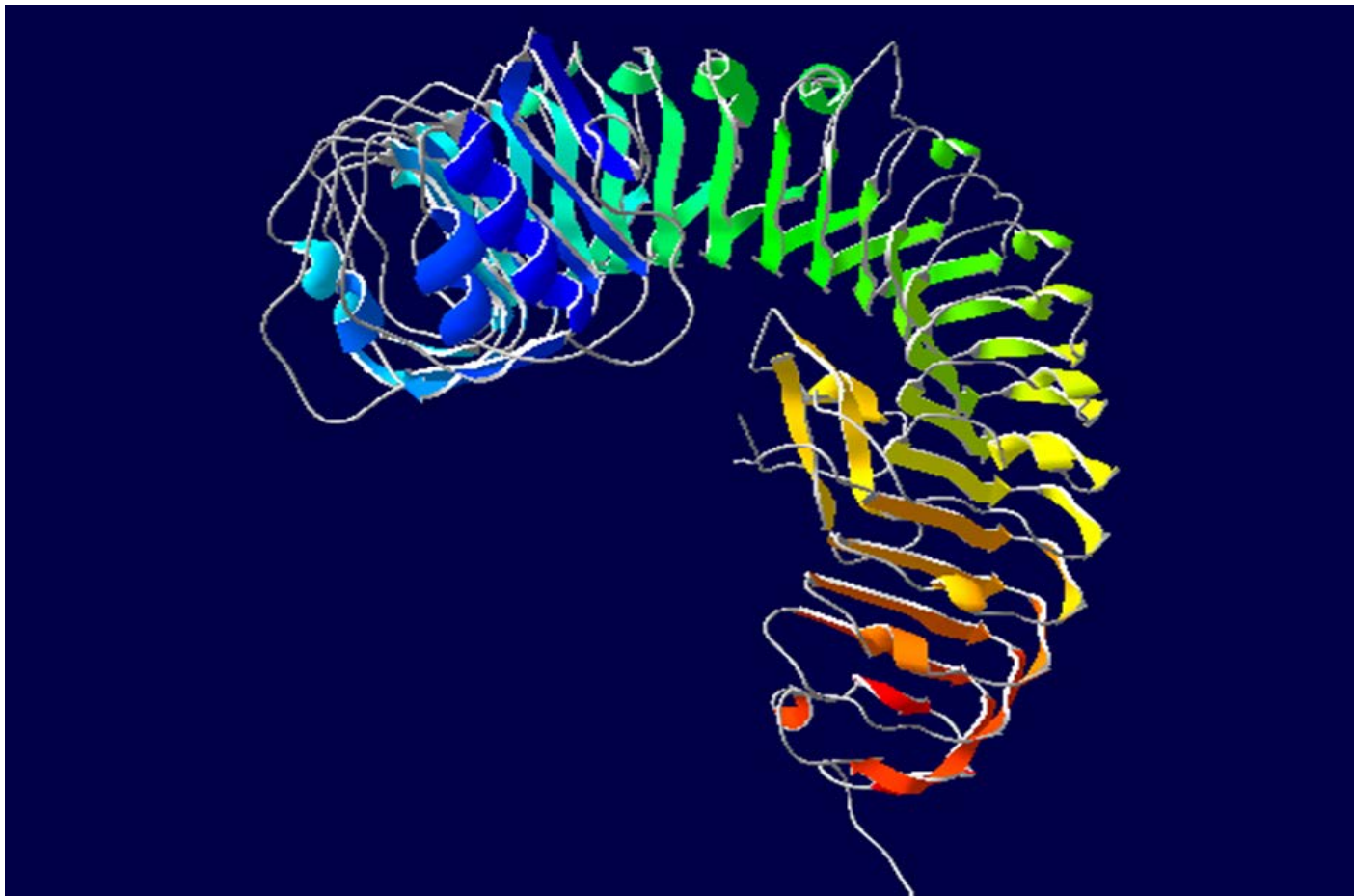


Psortb 亚细胞定位:

----- Final Results -----

mitochondrial inner membrane	---	Certainty= 0.860(Affirmative)	< succ>
plasma membrane	---	Certainty= 0.440(Affirmative)	< succ>
chloroplast thylakoid membrane	---	Certainty= 0.417(Affirmative)	< succ>
mitochondrial intermembrane space	---	Certainty= 0.362(Affirmative)	< succ>

Swiss-PDB viewer 三维结构预测：



总结：

- 生物信息学网站和软件为我们了解一段未知的基因序列的一般信息例如亚细胞定位，跨膜结构域，磷酸化位点以及存在的生物功能提供了参考依据，为我们的实验研究指引了方向，极大地提高了科研工作的效率。

谢谢