

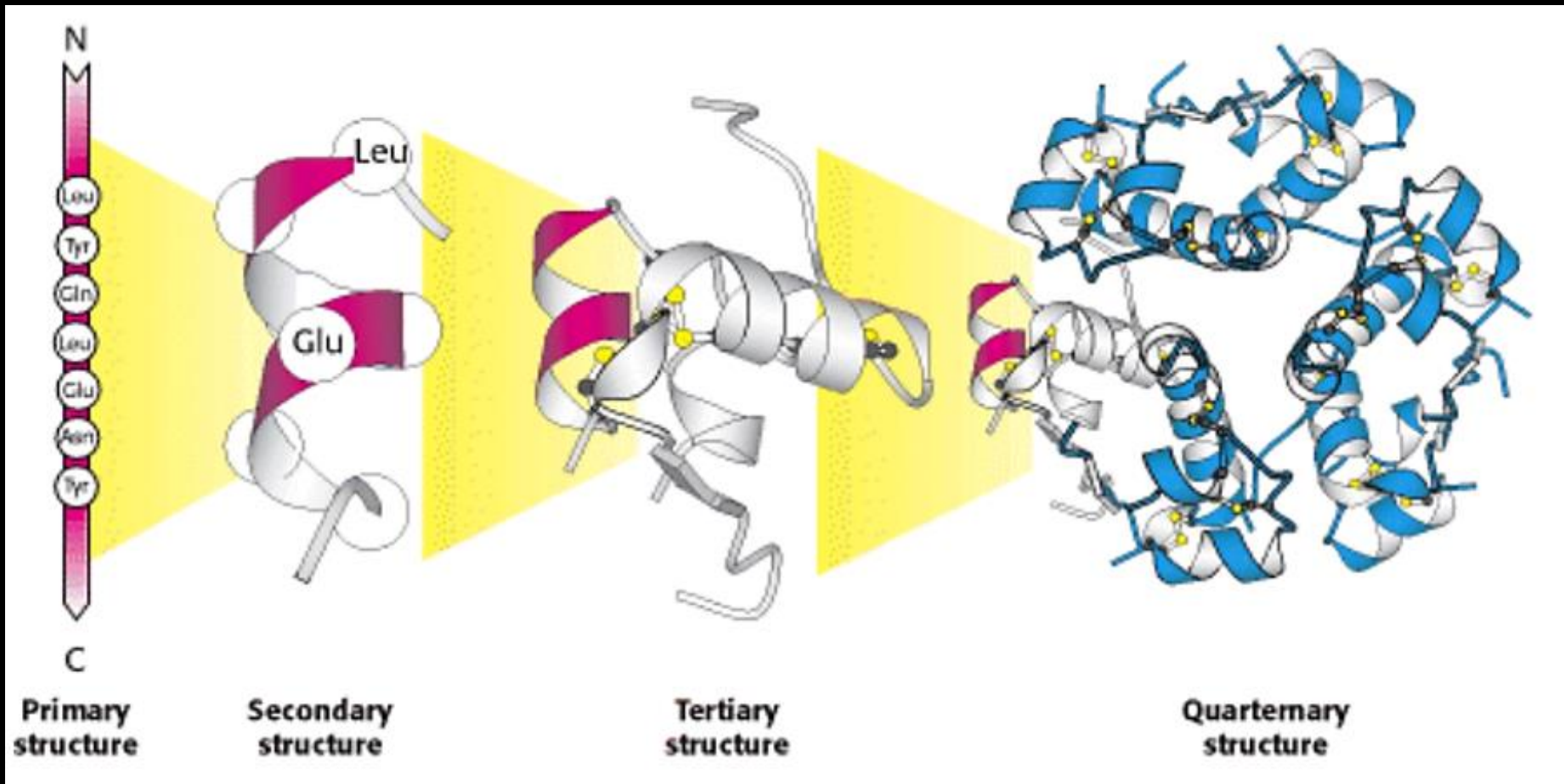


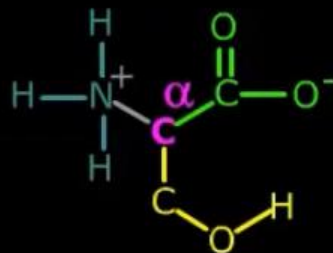
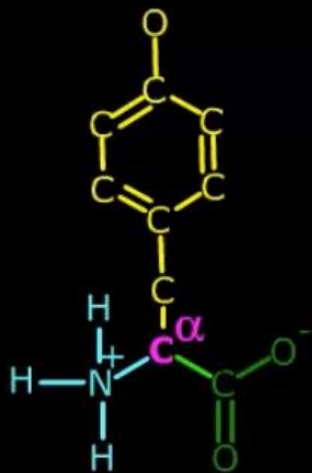
# Estrutura de Proteínas

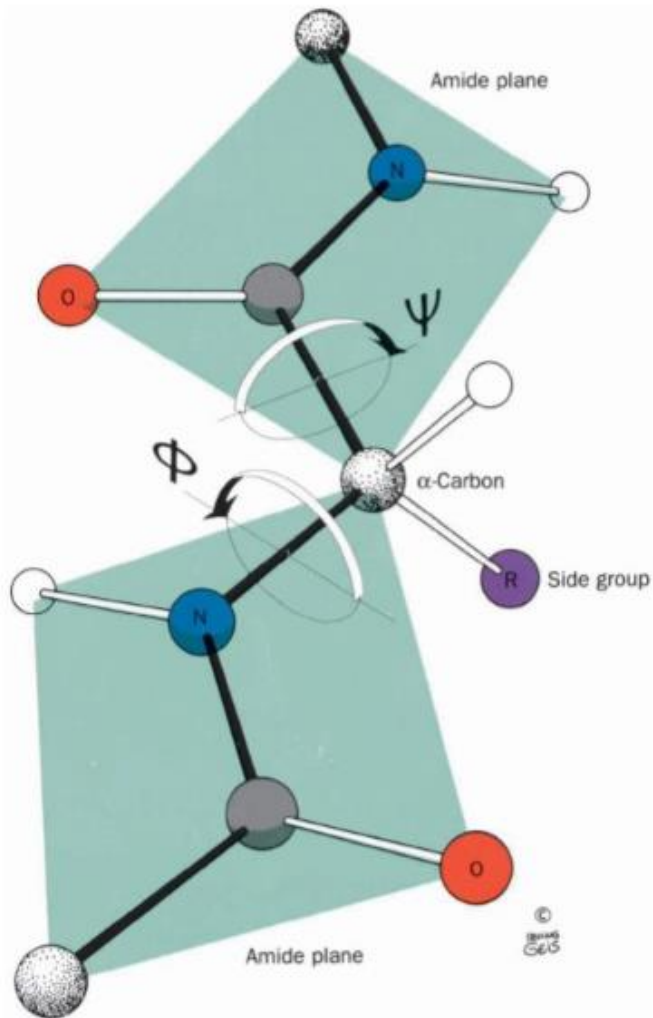
Ronaldo Bento Quaggio

QBQ0204 - Bioquímica

Estrutura de Biomoléculas e Metabolismo

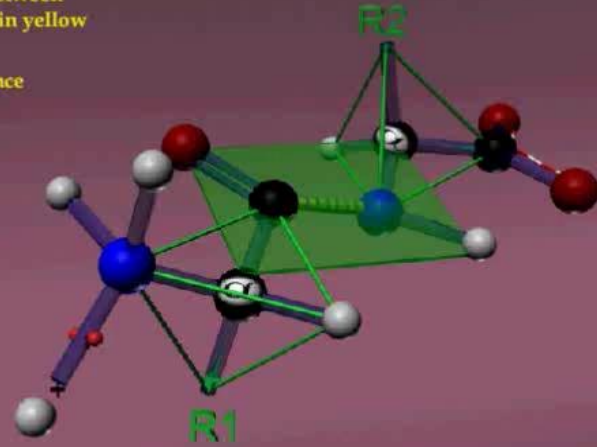






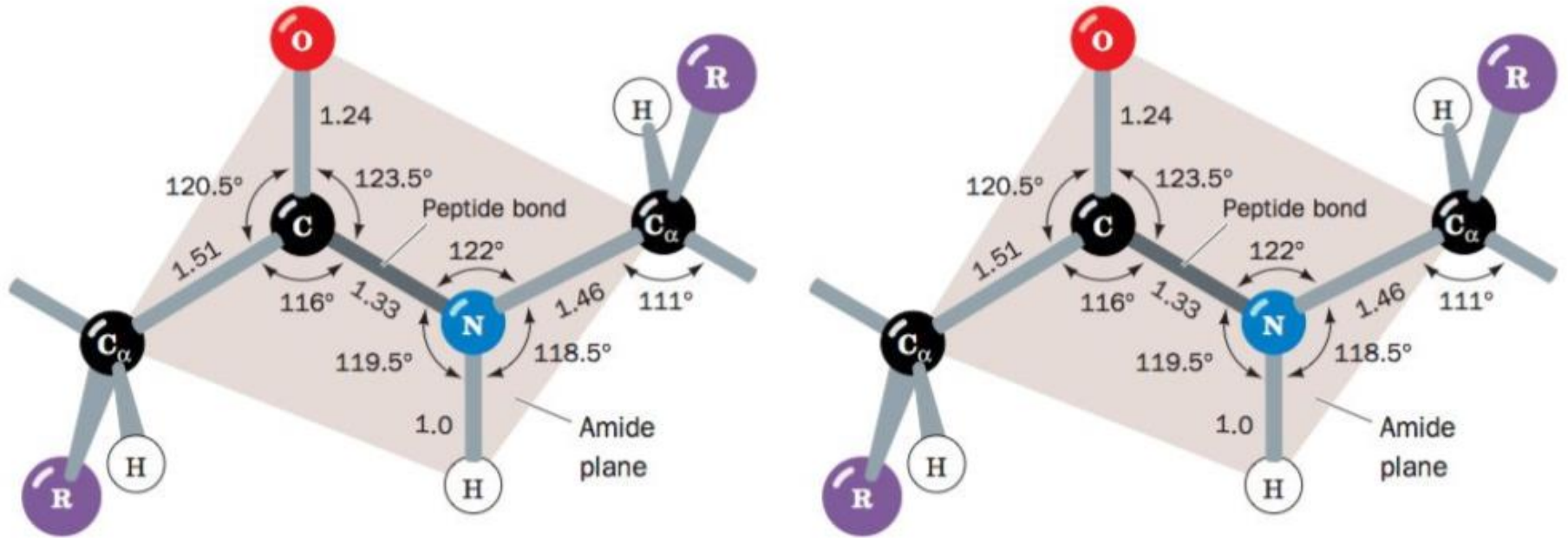
## The peptide bond

- 1) Hybrid  $\sigma$  bonds between R1 C<sub>O=O</sub> and R2 N in yellow
- 2)  $p$  orbitals in red
- 3)  $\pi$  bonds in resonance

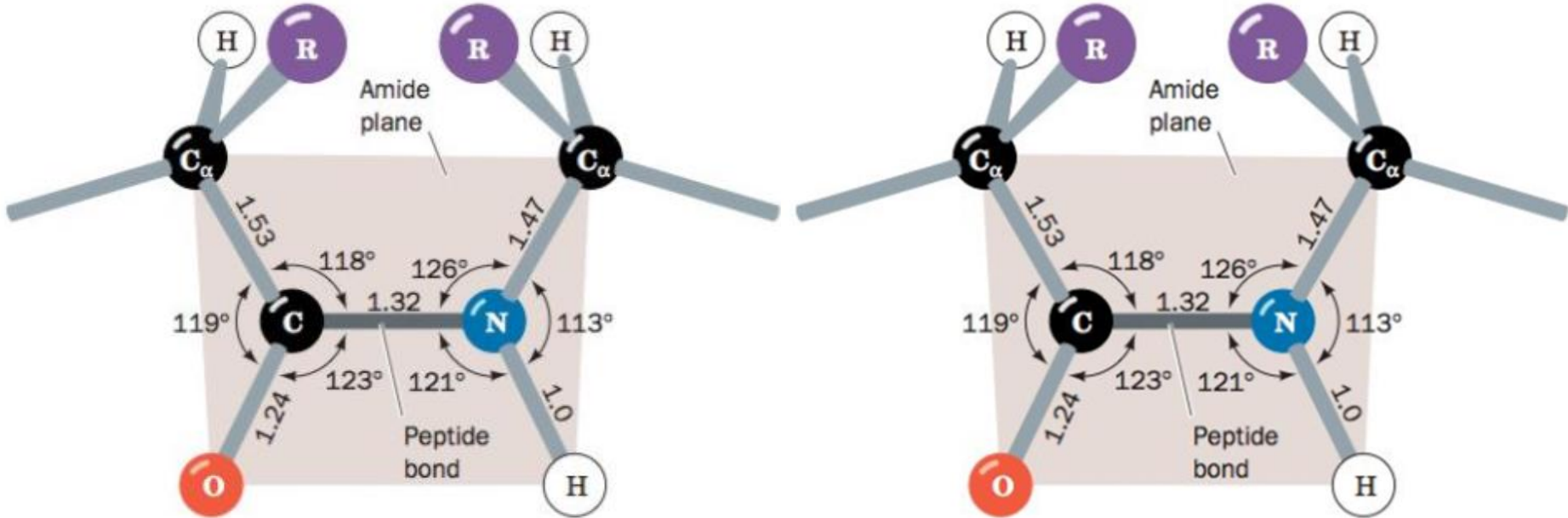


- 4) The peptide bond is planar tilted  $\sim 15^\circ$

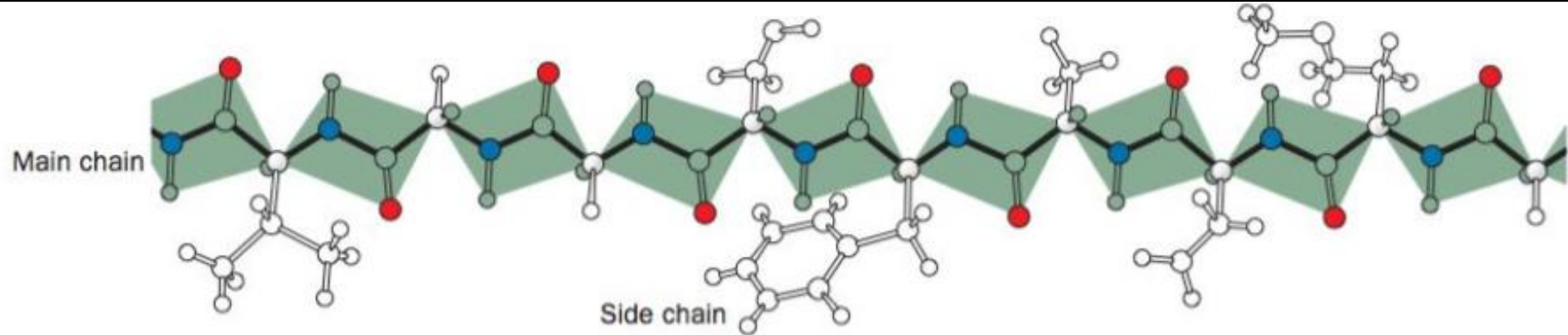
# Ligação peptídica trans



# Ligação peptídica cis



# Estrutura primária

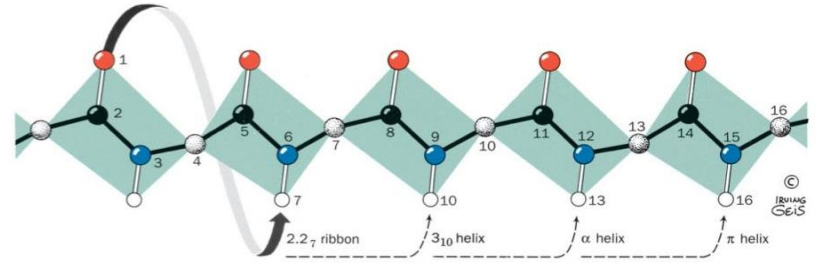
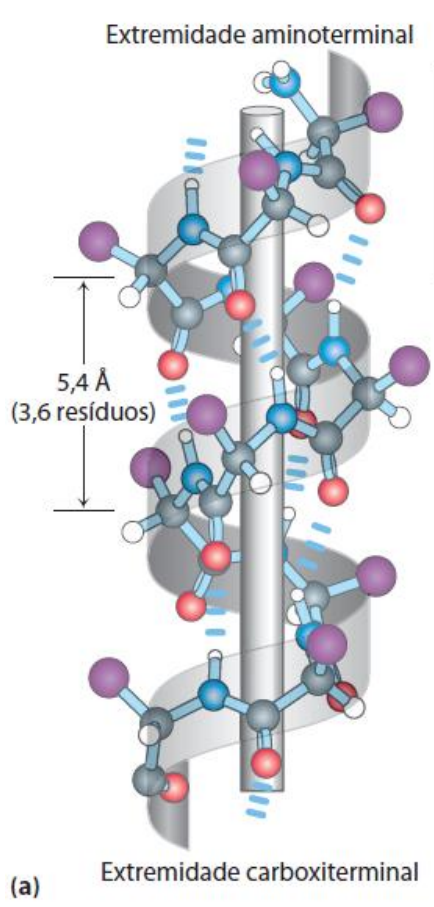
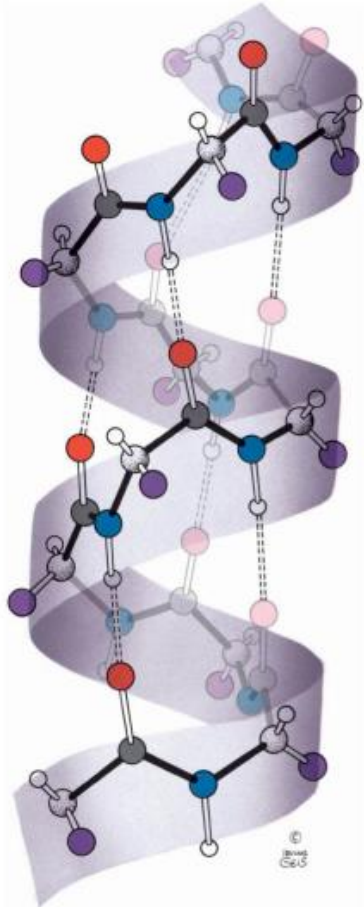




A estrutura primária é a sequência linear de aminoácidos unidos pela ligação peptídica que constitui uma proteína. Abaixo temos a estrutura primária da difteria toxina, com seus 535 aminoácidos.

Os aminoácidos estão escritos no [código de 3 letras](#).

1	GLY	ALA	ASP	ASP	VAL	VAL	ASP	SER	SER	LYS	10
11	SER	PHE	VAL	MET	GLU	ASN	PHE	SER	SER	TYR	20
21	HIS	GLY	THR	LYS	PRO	GLY	TYR	VAL	ASP	SER	30
31	ILE	GLN	LYS	GLY	ILE	GLN	LYS	PRO	LYS	SER	40
41	GLY	THR	GLN	GLY	ASN	TYR	ASP	ASP	ASP	TRP	50
51	LYS	GLY	PHE	TYR	SER	THR	ASP	ASN	LYS	TYR	60
61	ASP	ALA	ALA	GLY	TYR	SER	VAL	ASP	ASN	GLU	70
71	ASN	PRO	LEU	SER	GLY	LYS	ALA	GLY	GLY	VAL	80
81	VAL	LYS	VAL	THR	TYR	PRO	GLY	LEU	THR	LYS	90
91	VAL	LEU	ALA	LEU	LYS	VAL	ASP	ASN	ALA	GLU	100
101	THR	ILE	LYS	LYS	GLU	LEU	GLY	LEU	SER	LEU	110
111	THR	GLU	PRO	LEU	MET	GLU	GLN	VAL	GLY	THR	120
121	GLU	GLU	PHE	ILE	LYS	ARG	PHE	GLY	ASP	GLY	130
131	ALA	SER	ARG	VAL	VAL	LEU	SER	LEU	PRO	PHE	140
141	ALA	GLU	GLY	SER	SER	SER	VAL	GLU	TYR	ILE	150
151	ASN	ASN	TRP	GLU	GLN	ALA	LYS	ALA	LEU	SER	160
161	VAL	GLU	LEU	GLU	ILE	ASN	PHE	GLU	THR	ARG	170
171	GLY	LYS	ARG	GLY	GLN	ASP	ALA	MET	TYR	GLU	180
181	TYR	MET	ALA	GLN	ALA	CYS	ALA	GLY	ASN	ARG	190
191	VAL	ARG	ARG	SER	VAL	GLY	SER	SER	LEU	SER	200
201	CYS	ILE	ASN	LEU	ASP	TRP	ASP	VAL	ILE	ARG	210
211	ASP	LYS	THR	LYS	THR	LYS	ILE	GLU	SER	LEU	220
221	LYS	GLU	HIS	GLY	PRO	ILE	LYS	ASN	LYS	MET	230
231	SER	GLU	SER	PRO	ASN	LYS	THR	VAL	SER	GLU	240
241	GLU	LYS	ALA	LYS	GLN	TYR	LEU	GLU	GLU	PHE	250
251	HIS	GLN	THR	ALA	LEU	GLU	HIS	PRO	GLU	LEU	260
261	SER	GLU	LEU	LYS	THR	VAL	THR	GLY	THR	ASN	270
271	PRO	VAL	PHE	ALA	GLY	ALA	ASN	TYR	ALA	ALA	280
281	TRP	ALA	VAL	ASN	VAL	ALA	GLN	VAL	ILE	ASP	290
291	SER	GLU	THR	ALA	ASP	ASN	LEU	GLU	LYS	THR	300
301	THR	ALA	ALA	LEU	SER	ILE	LEU	PRO	GLY	ILE	310
311	GLY	SER	VAL	MET	GLY	ILE	ALA	ASP	GLY	ALA	320
321	VAL	HIS	HIS	ASN	THR	GLU	GLU	ILE	VAL	ALA	330
331	GLN	SER	ILE	ALA	LEU	SER	SER	LEU	MET	VAL	340
341	ALA	GLN	ALA	ILE	PRO	LEU	VAL	GLY	GLU	LEU	350
351	VAL	ASP	ILE	GLY	PHE	ALA	ALA	TYR	ASN	PHE	360
361	VAL	GLU	SER	ILE	ILE	ASN	LEU	PHE	GLN	VAL	370
371	VAL	HIS	ASN	SER	TYR	ASN	ARG	PRO	ALA	TYR	380
381	ASP	PRO	GLY	HIS	LYS	THR	GLN	PRO	PHE	LEU	390
391	HIS	ASP	GLY	TYR	ALA	VAL	SER	TRP	ASN	THR	400
401	VAL	GLU	ASP	SER	ILE	ILE	ARG	THR	GLY	PHE	410
411	GLN	GLY	GLU	SER	GLY	HIS	ASP	ILE	LYS	ILE	420
421	THR	ALA	GLU	ASN	THR	PRO	LEU	PRO	ILE	ALA	430
431	GLY	VAL	LEU	LEU	PRO	THR	ILE	PRO	GLY	LYS	440
441	LEU	ASP	VAL	ASN	LYS	SER	LYS	THR	HIS	ILE	450
451	SER	VAL	ASN	GLY	ARG	LYS	ILE	ARG	MET	ARG	460
461	CYS	ARG	ALA	ILE	ASP	GLY	ASP	VAL	THR	PHE	470
471	CYS	ARG	PRO	LYS	SER	PRO	VAL	TYR	VAL	GLY	480
481	ASN	GLY	VAL	HIS	ALA	ASN	LEU	HIS	VAL	ALA	490
491	PHE	HIS	ARG	SER	SER	SER	GLU	LYS	ILE	HIS	500
501	SER	ASN	GLU	ILE	SER	SER	ASP	SER	ILE	GLY	510
511	VAL	LEU	GLY	TYR	GLN	LYS	THR	VAL	ASP	HIS	520
521	THR	LYS	VAL	ASN	SER	LYS	LEU	SER	LEU	PHE	530
531	PHE	GLU	ILE	LYS							535

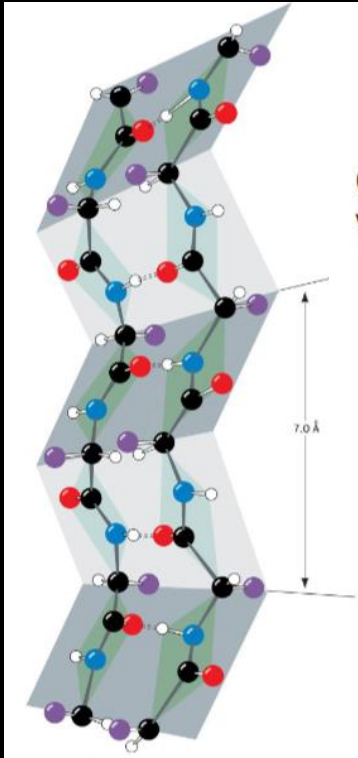


# Estrutura Secundária

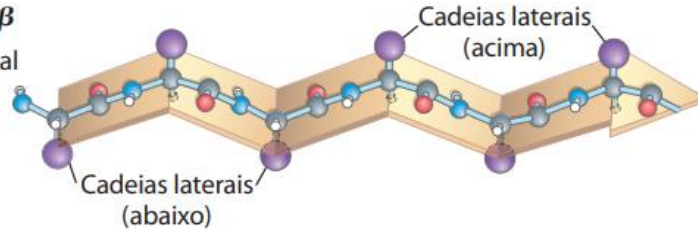
# α-Hélice



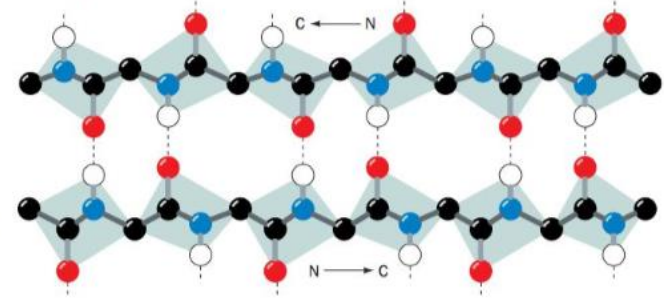
# Folhas $\beta$ pregueadas



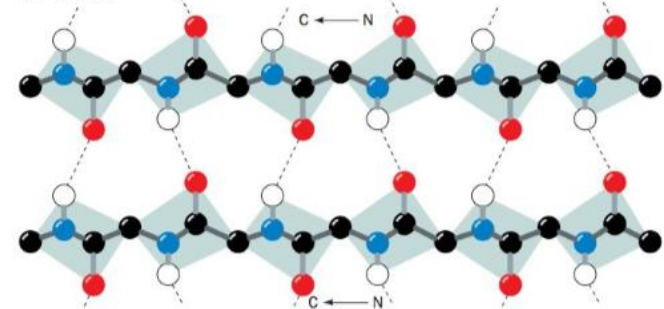
(a) Folha  $\beta$   
Visão lateral



(a) Antiparalela

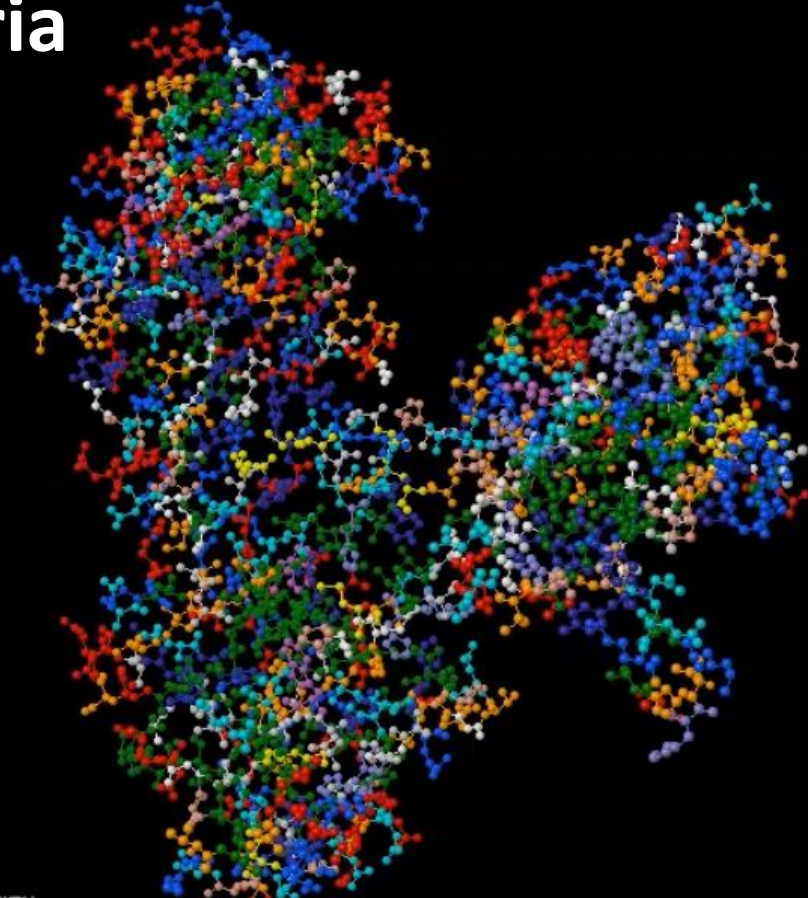


(b) Paralela



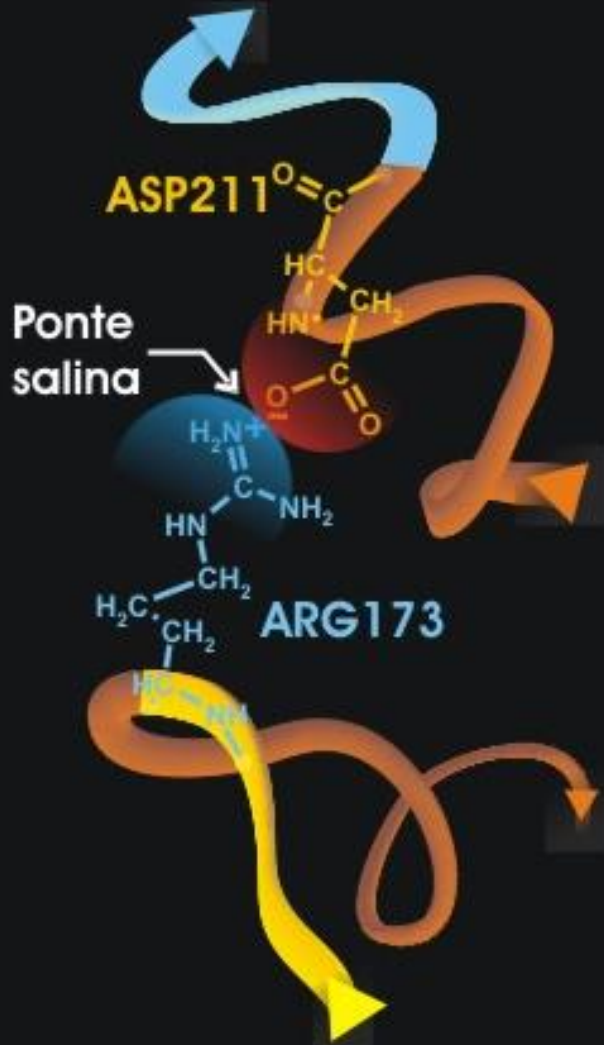


# Estrutura Terciária



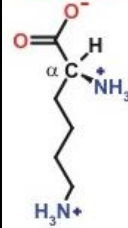


# Ponte salina

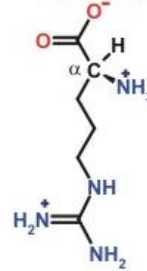


## Aminoácidos de resíduo positivo

### Lisina (Lys)

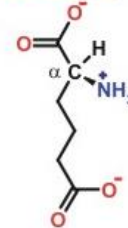


### Arginina (Arg)

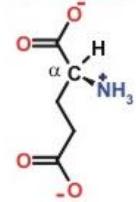


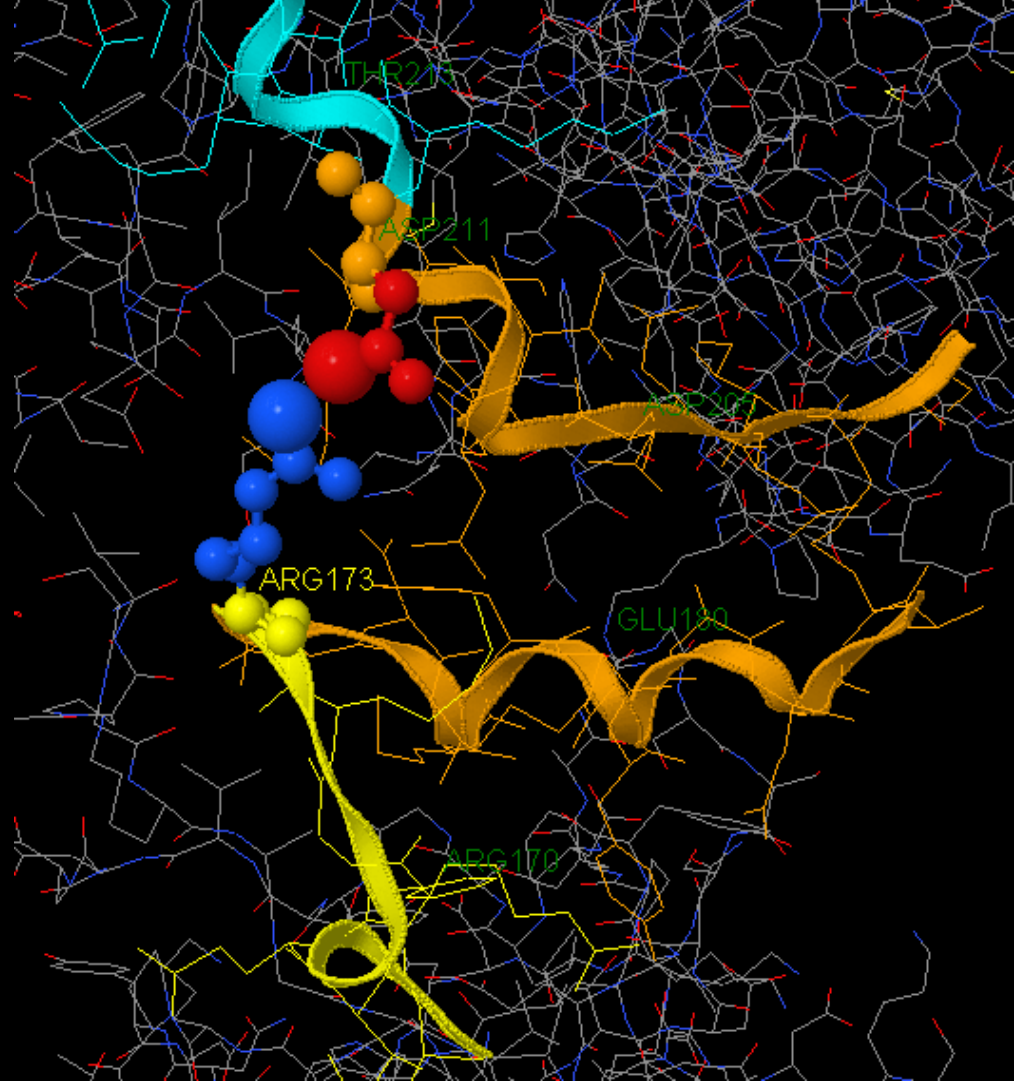
## Aminoácidos de resíduo negativo

### Glutamato (Glu)

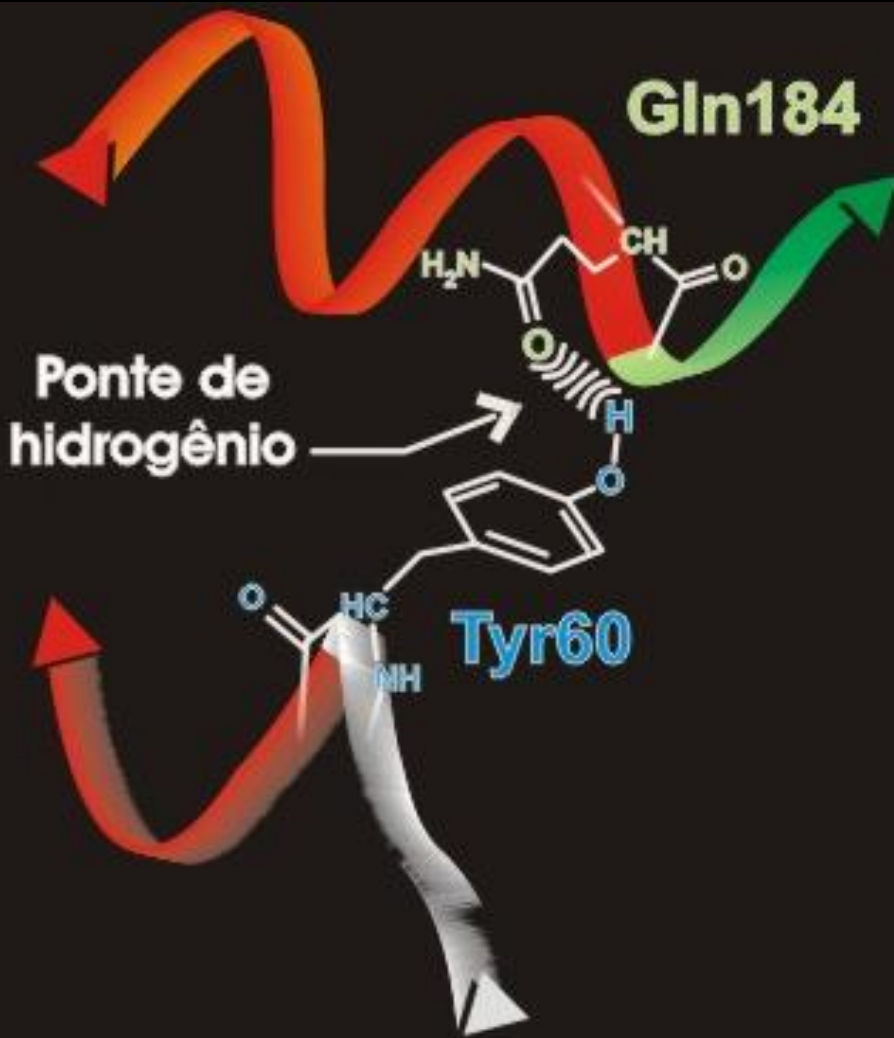


### Aspartato (Asp)

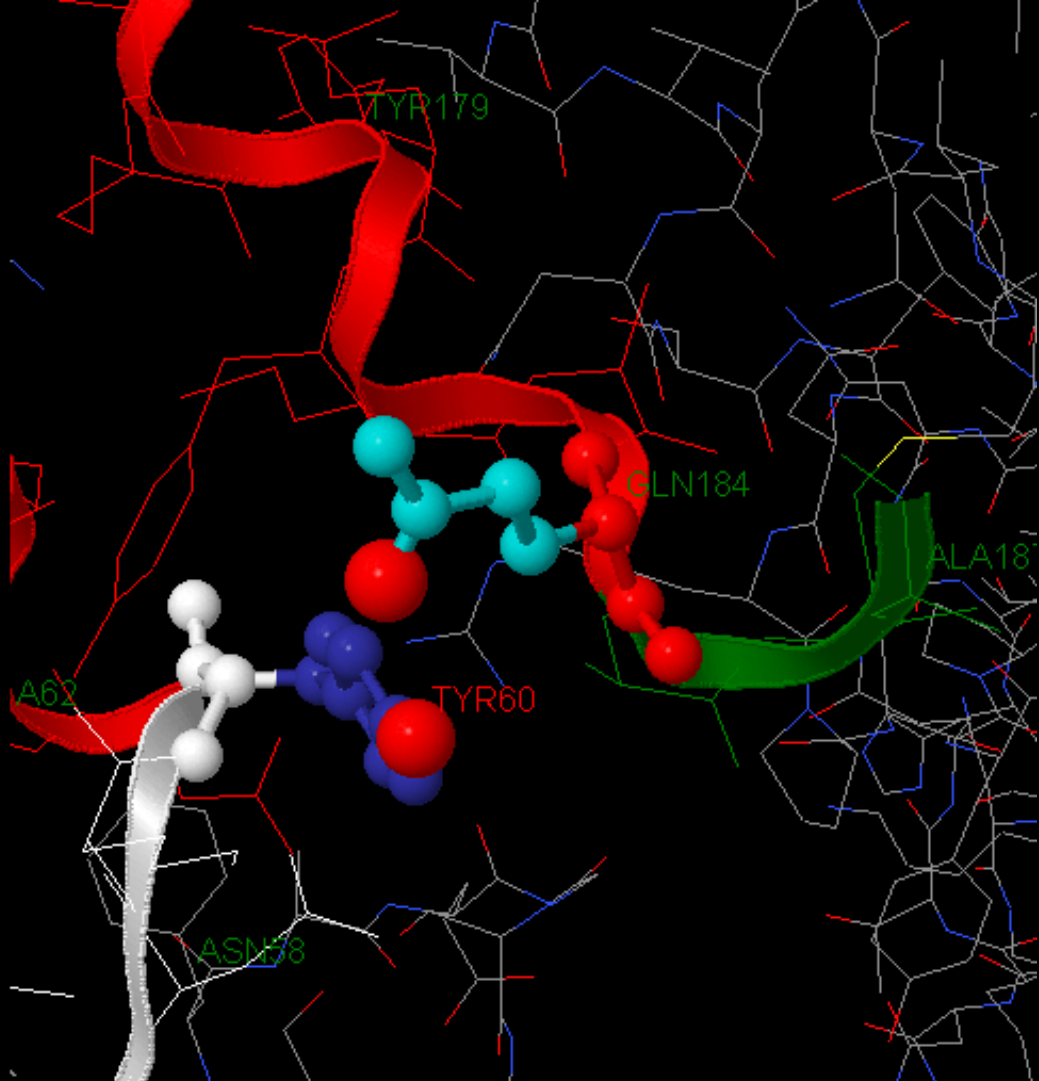


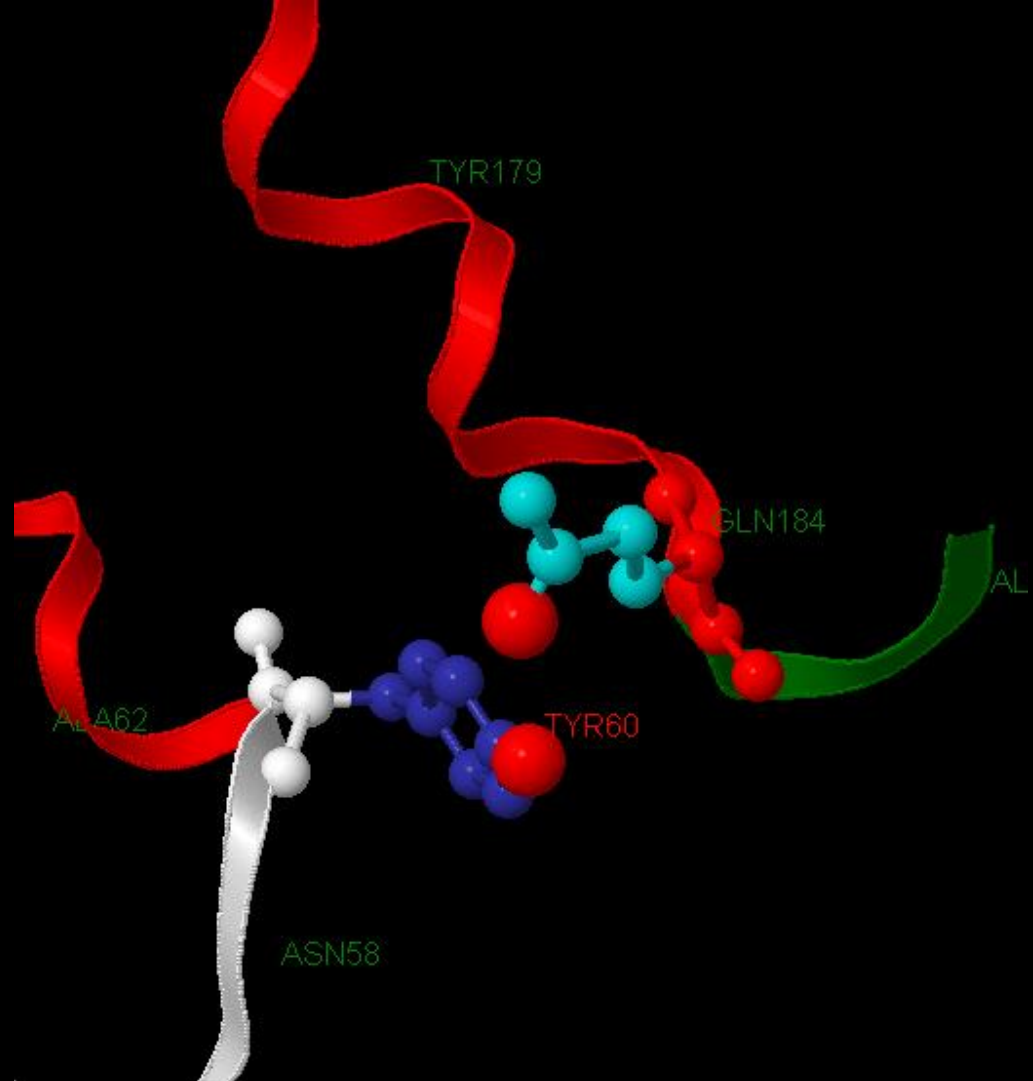


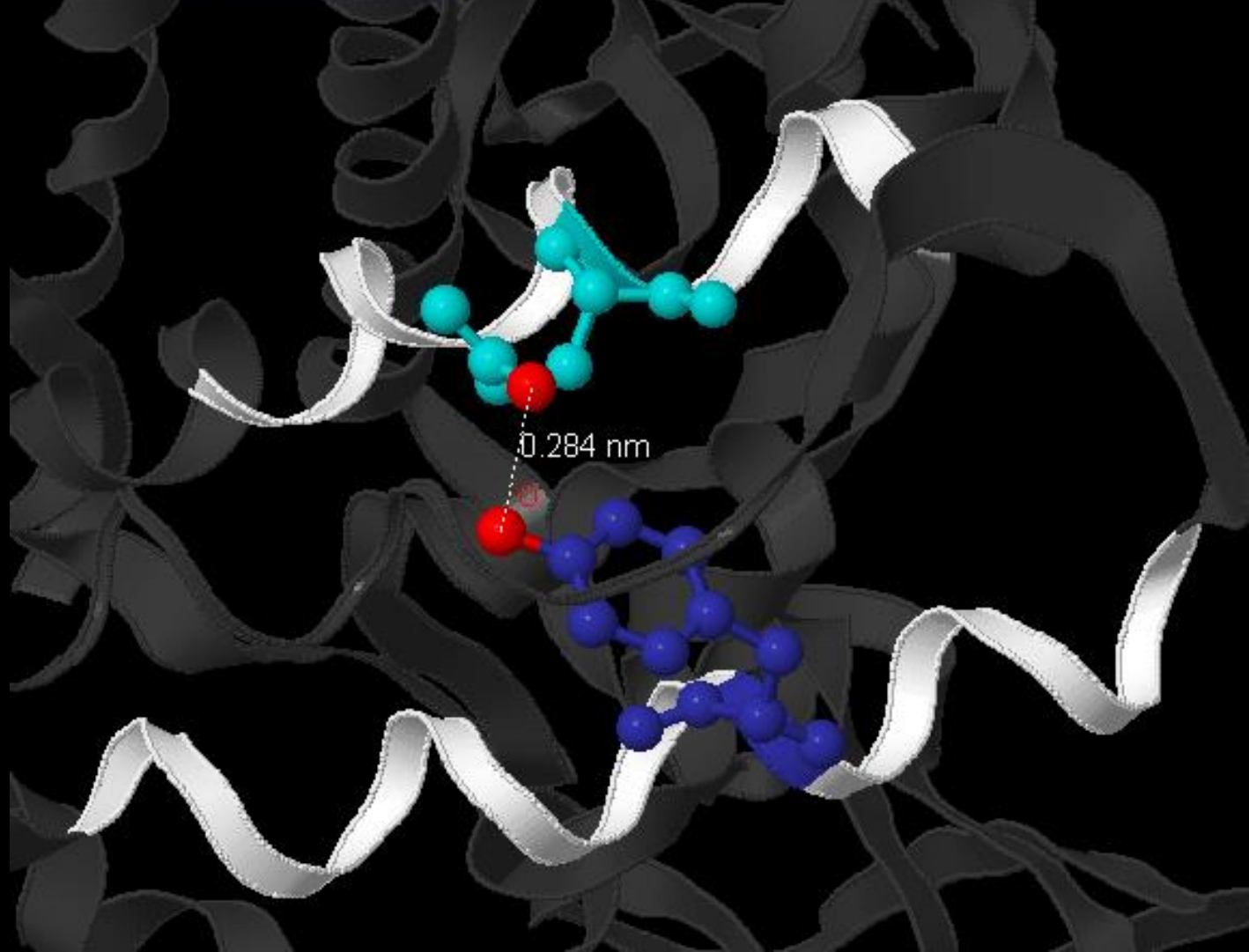




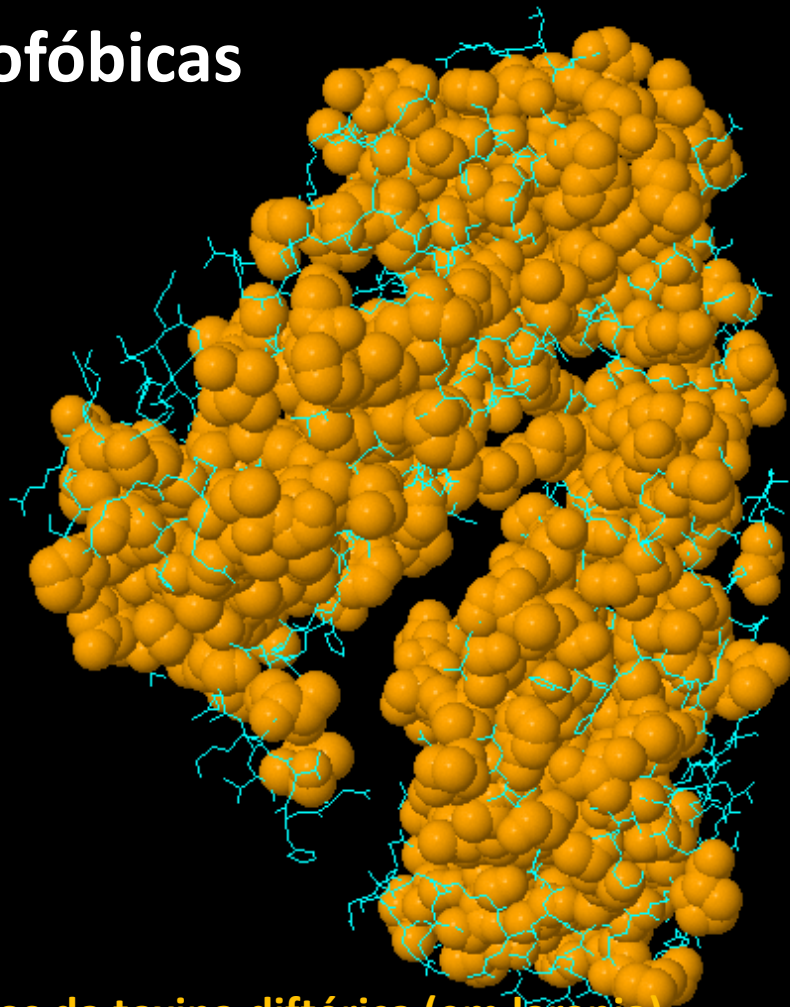
Ponte de hidrogênio





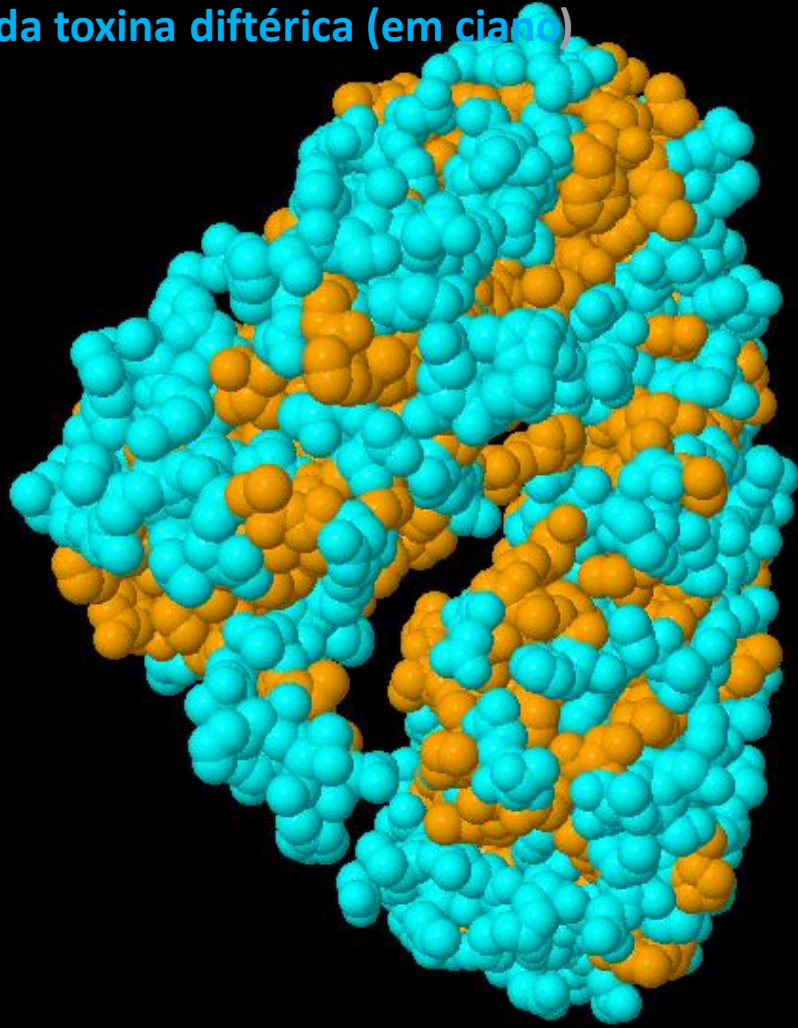


# Interações Hidrofóbicas

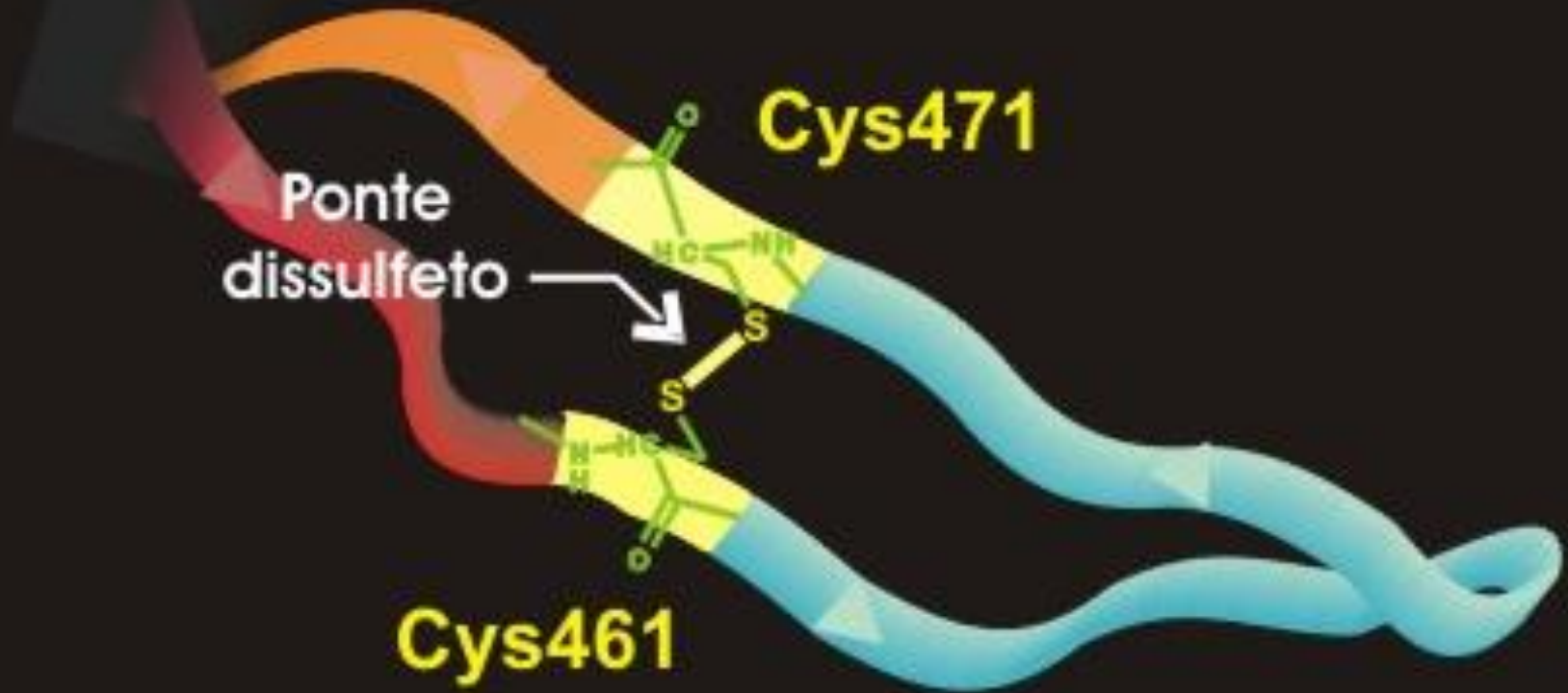


**Aminoácidos hidrofóbicos da toxina diftérica (em laranja)**

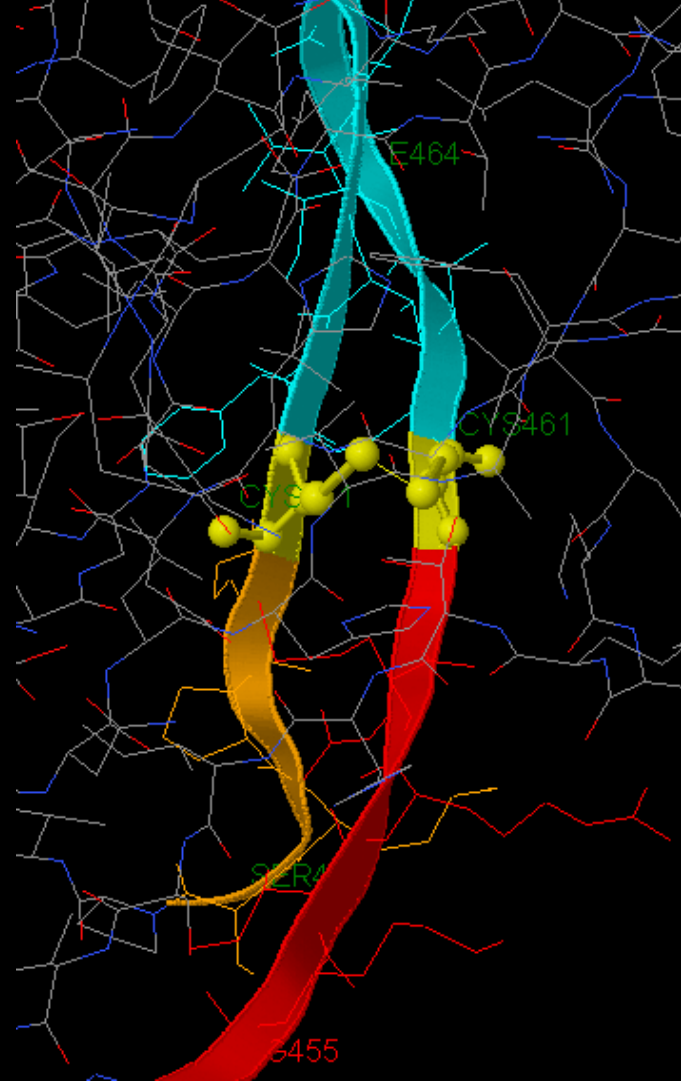
Aminoácidos hidrofílicos da toxina diftérica (em ciano)



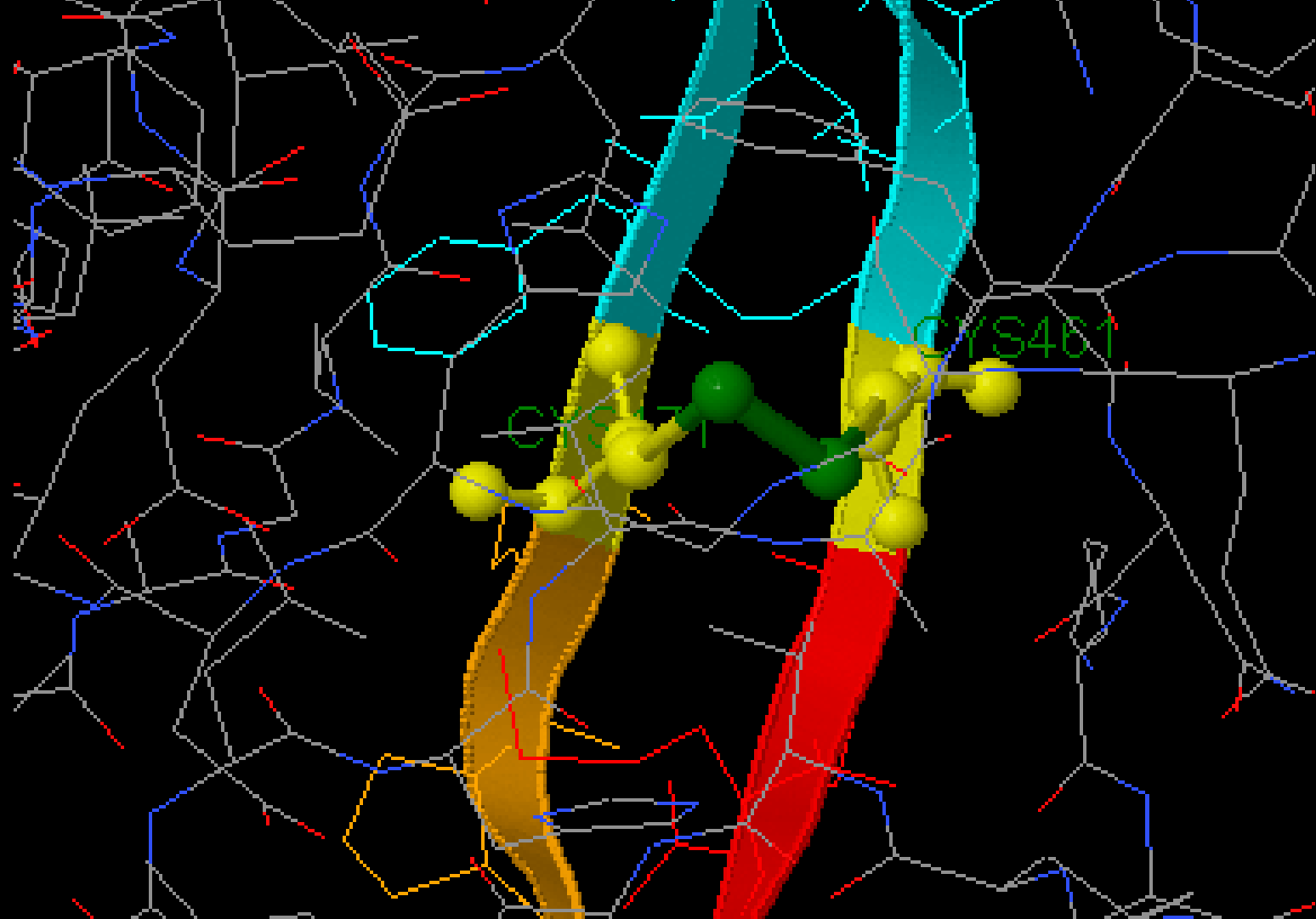
# Ponte dissulfeto



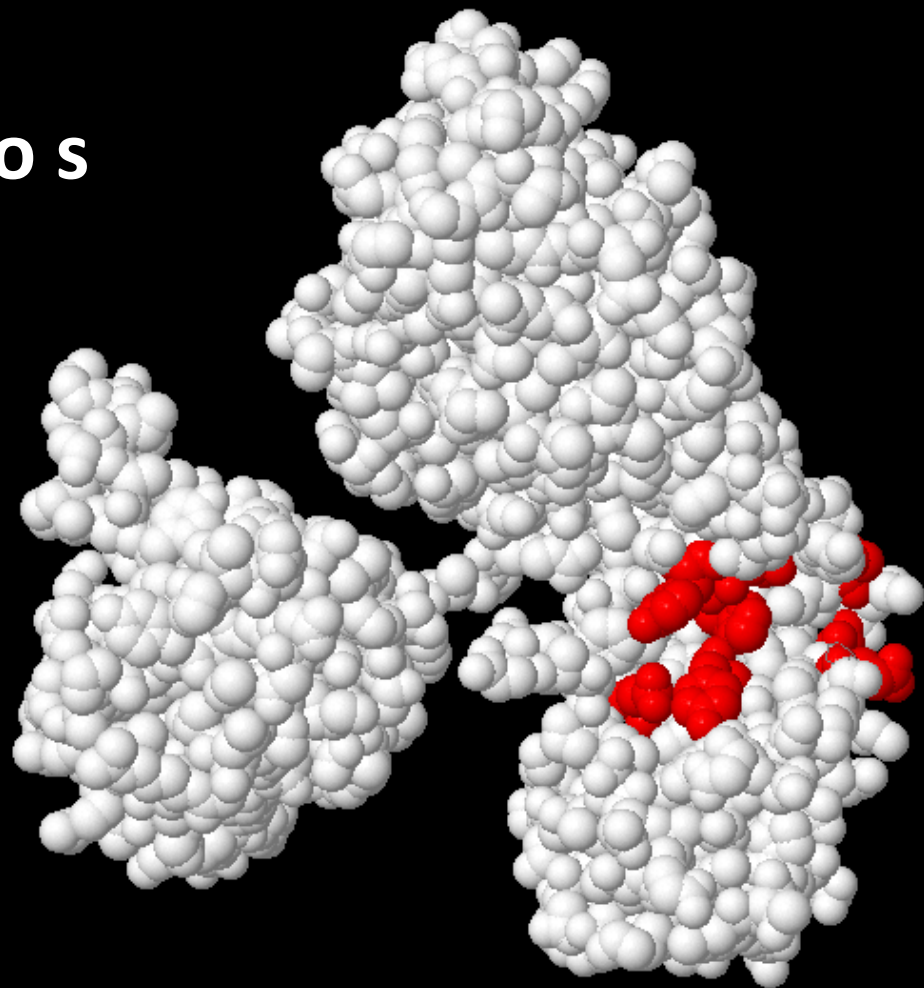


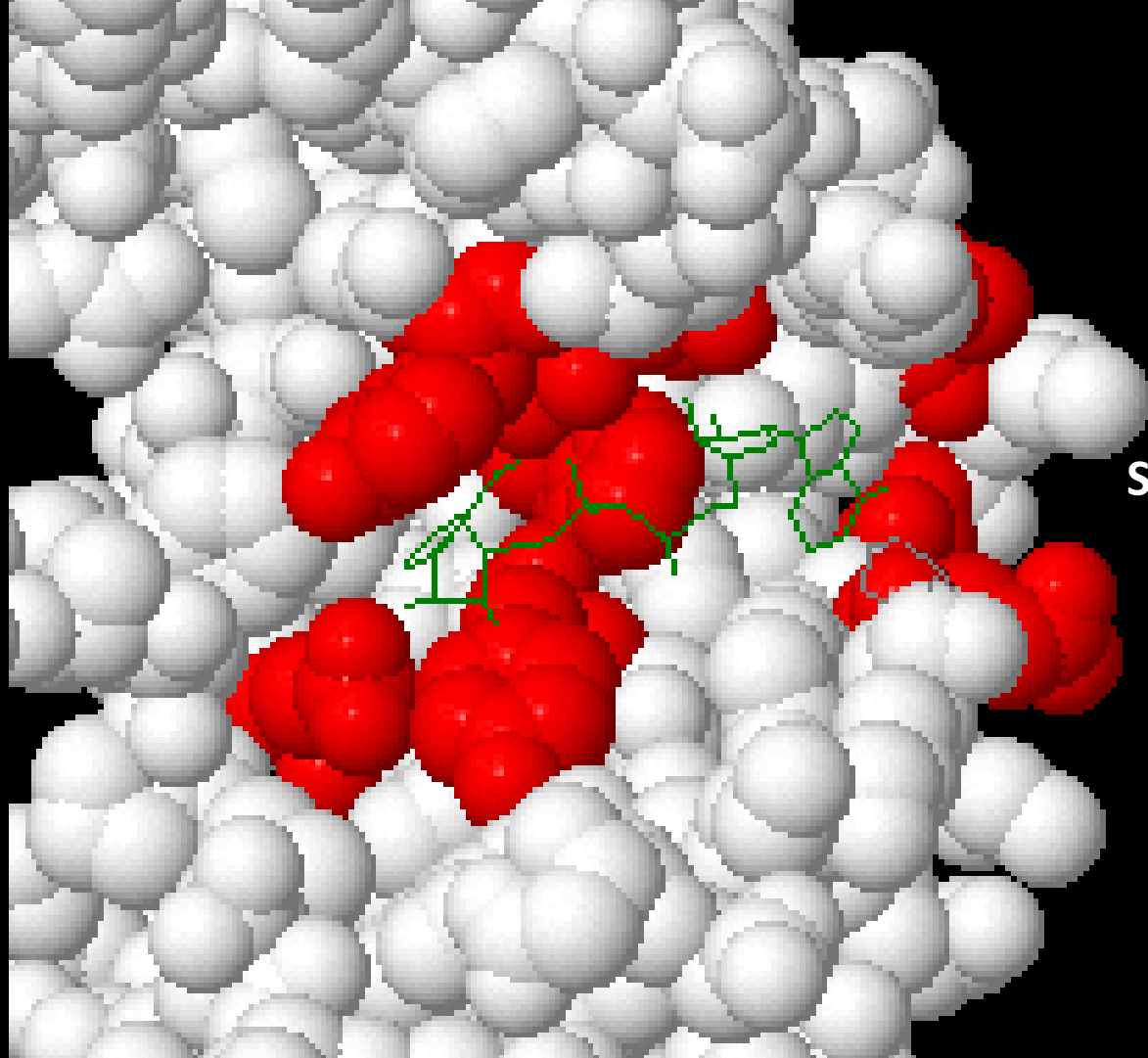






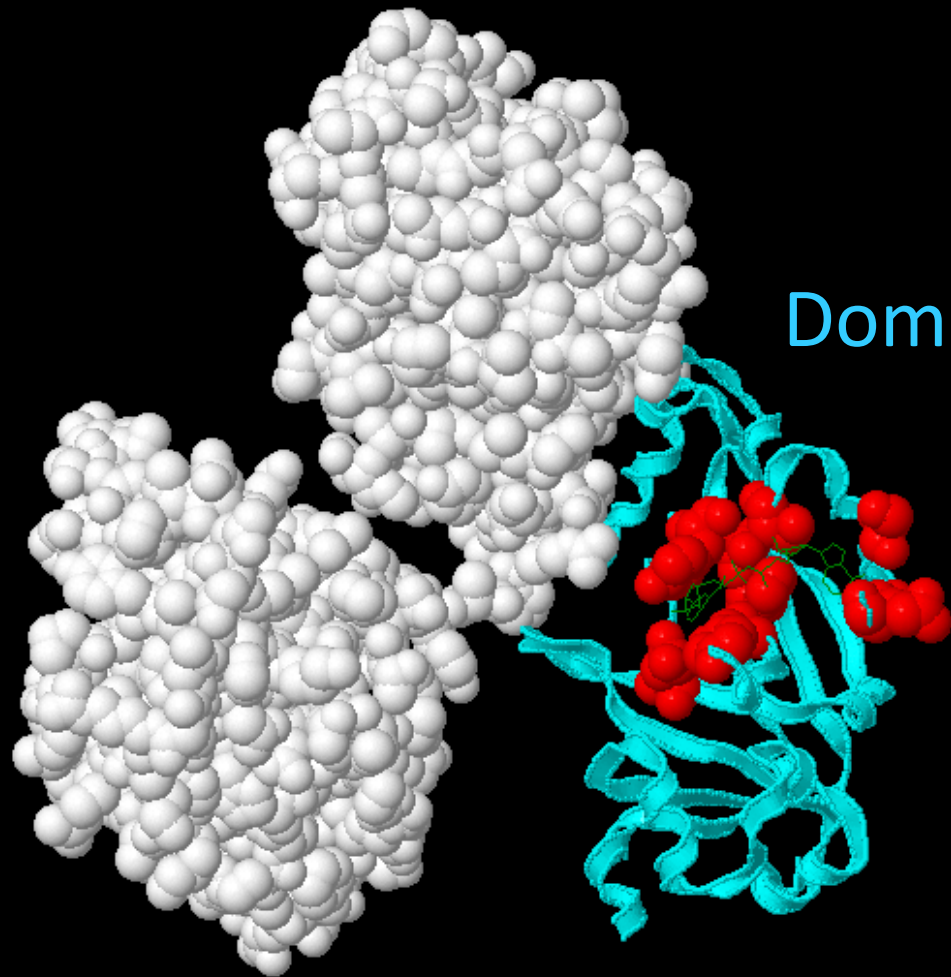
# Domínios





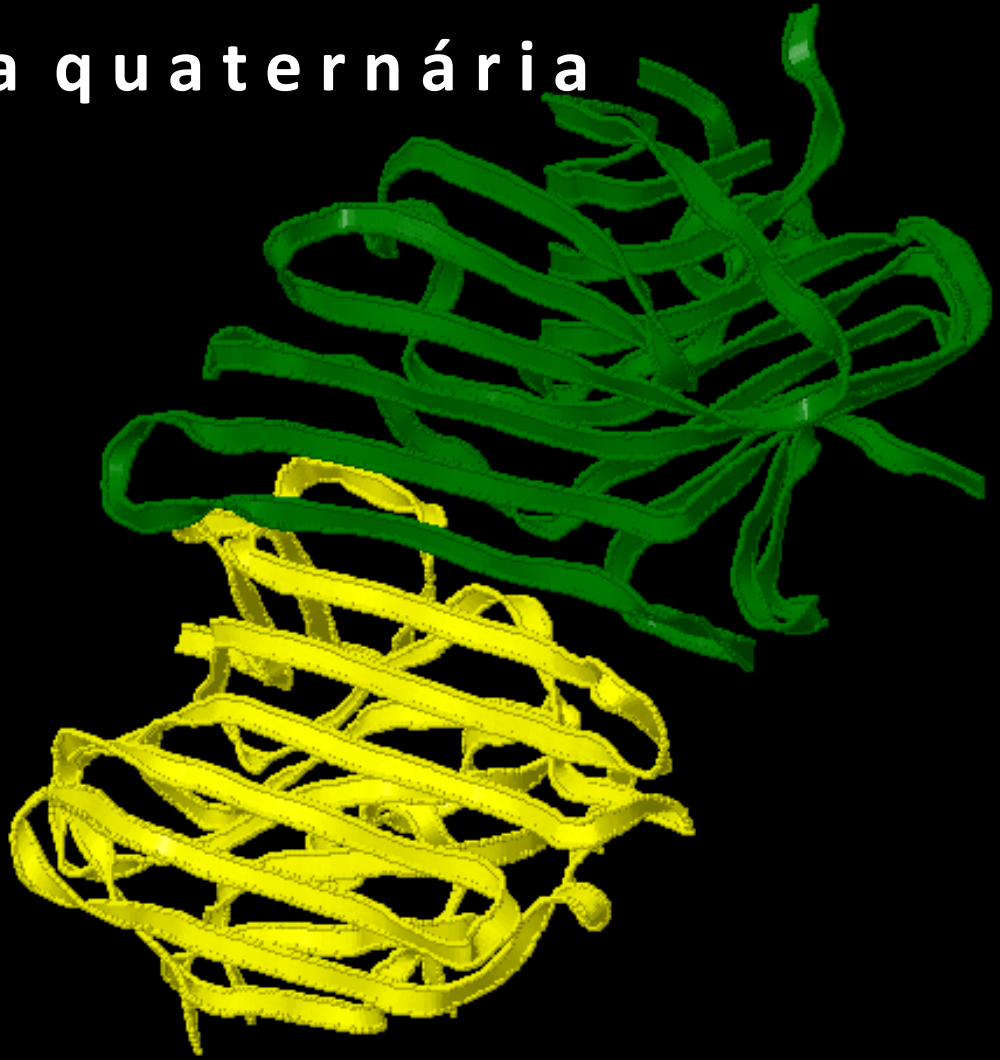
Substrato no sítio ativo

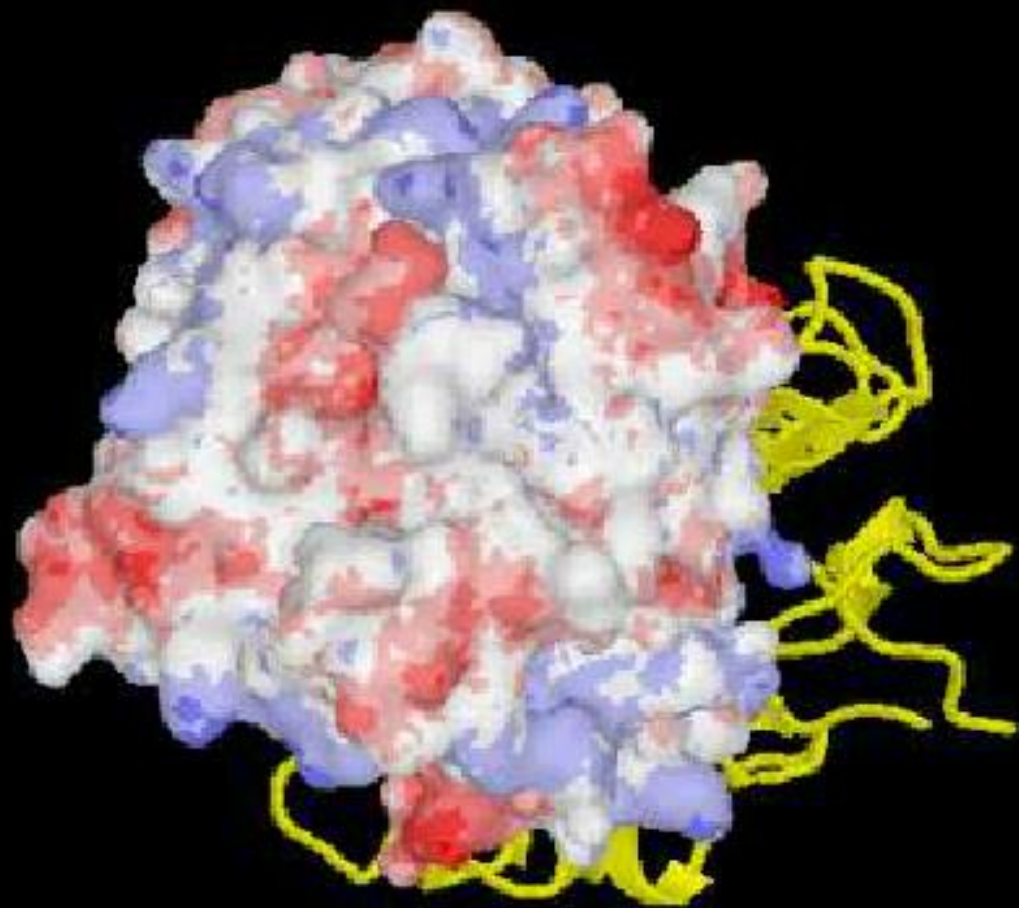
**NAD**

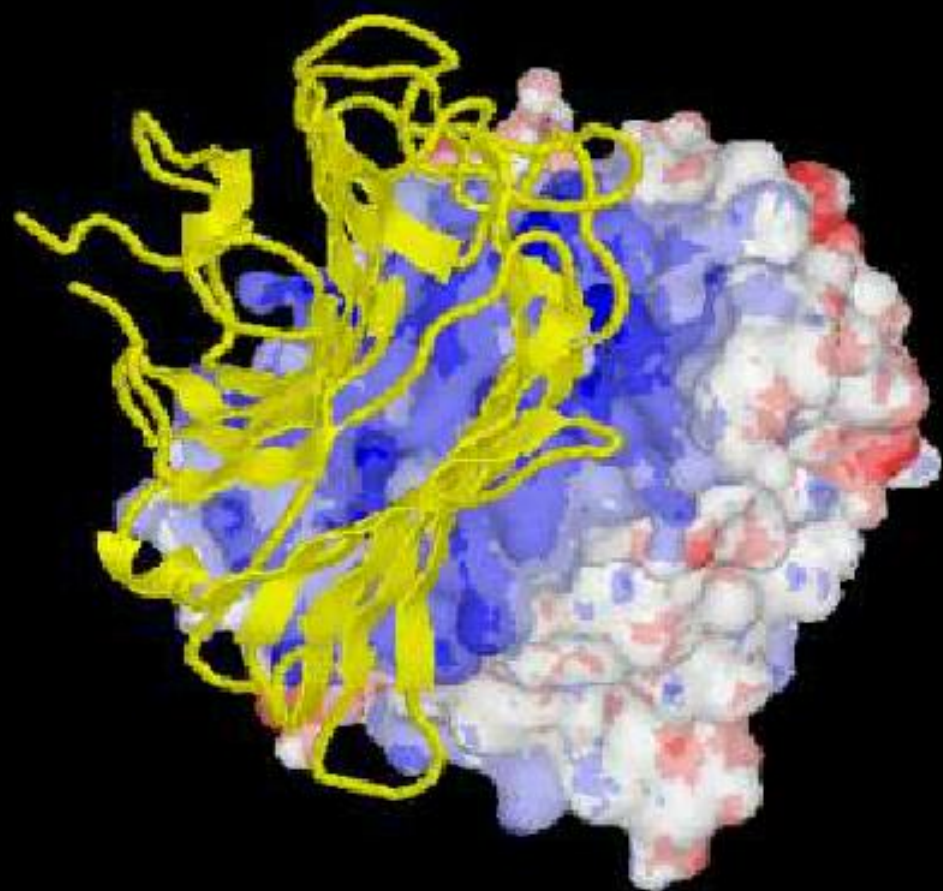


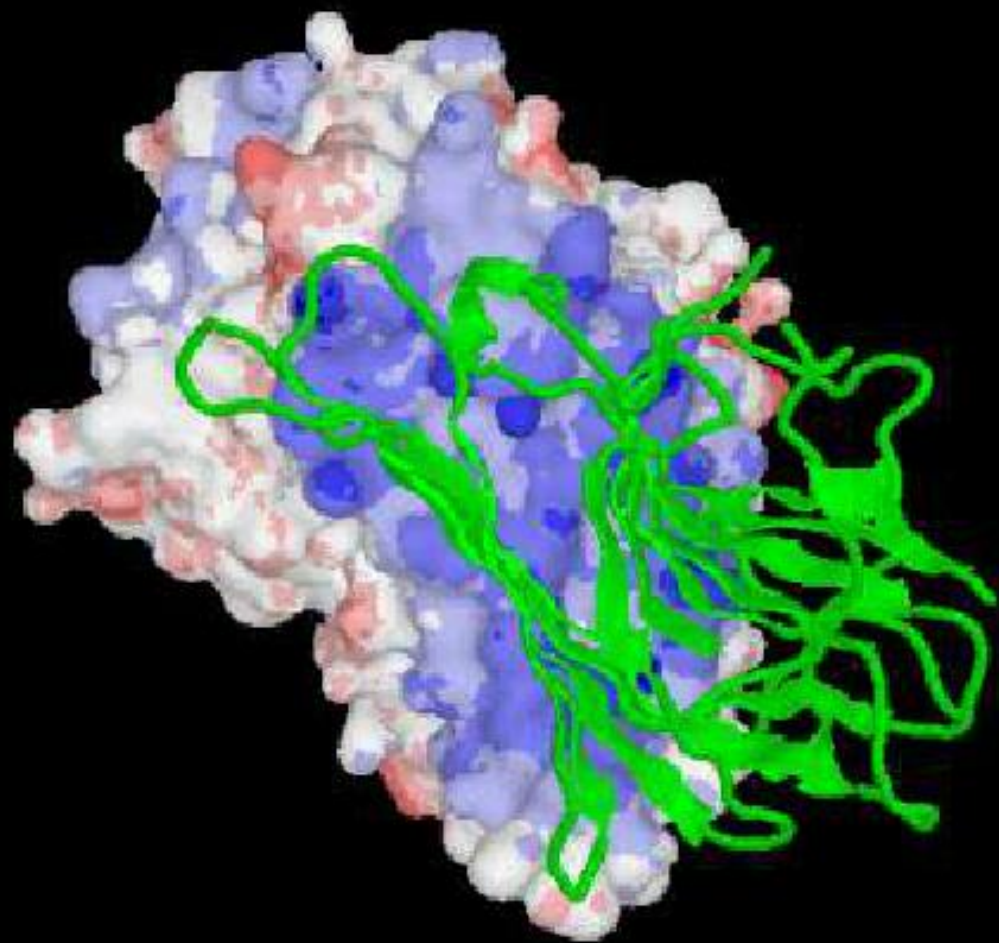
Domínio catalítico

# Estrutura quaternária

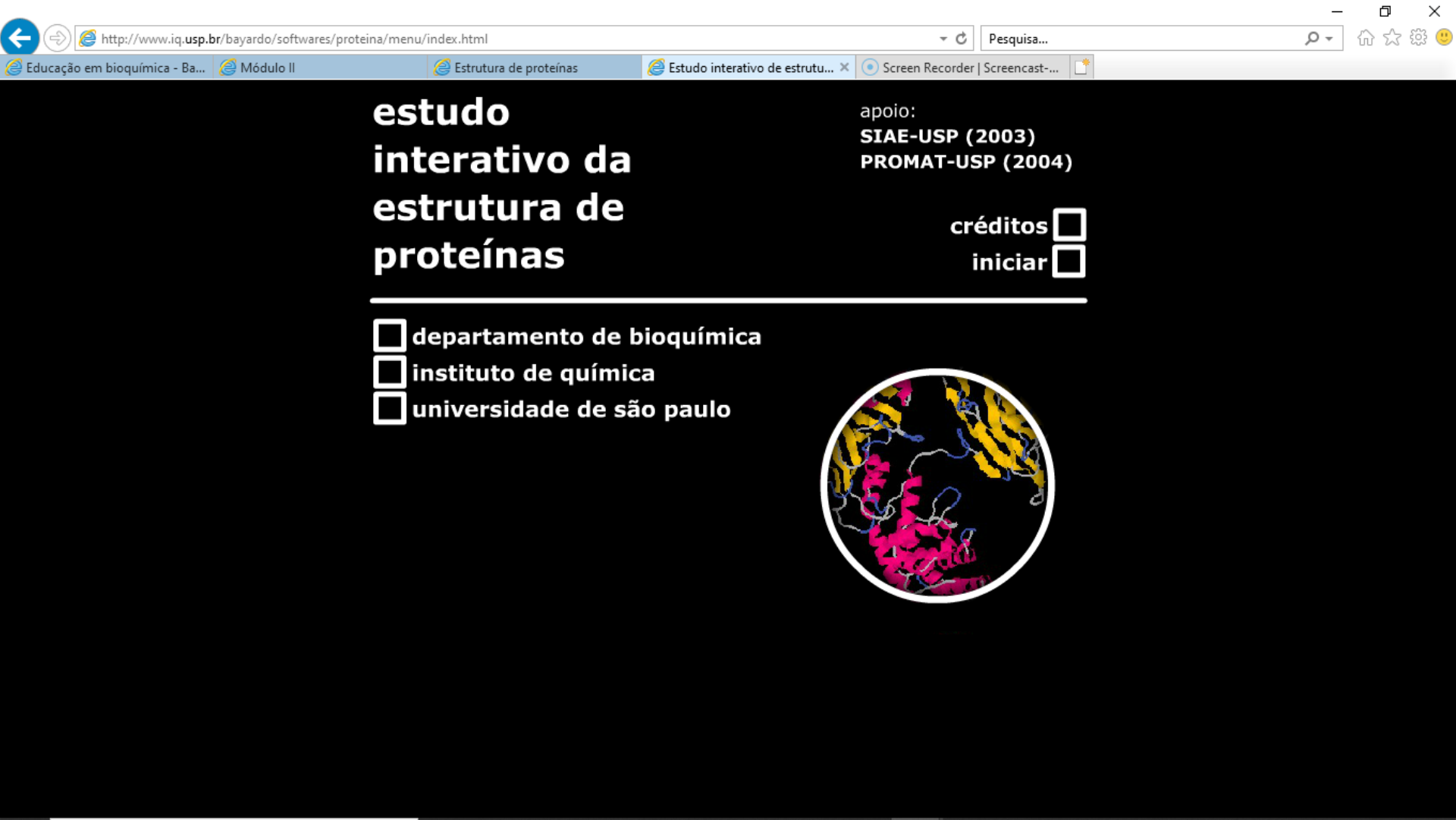












# estudo interativo da estrutura de proteínas

apoio:  
**SIAE-USP (2003)**  
**PROMAT-USP (2004)**

créditos   
iniciar

- 
- departamento de bioquímica
  - instituto de química
  - universidade de são paulo

