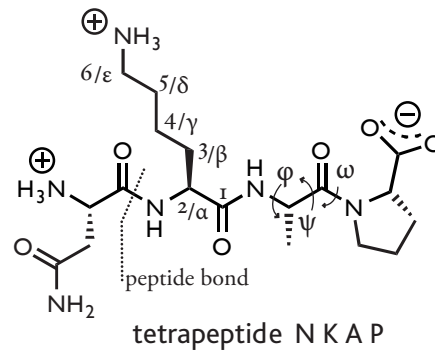
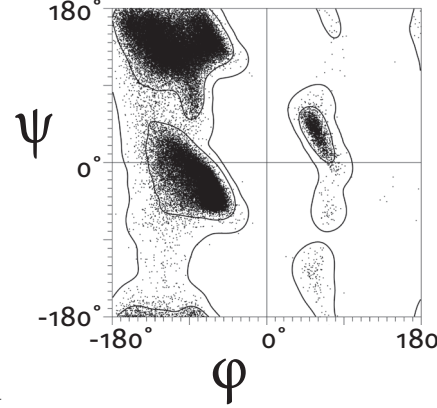


# amino acids

codons read from large to small, all molecules protonated at biological pH, side chain pK<sub>a</sub> values rounded to one decimal place from CRC *handbook of chemistry and physics*. CRC press, 88<sup>th</sup> edition, 2007

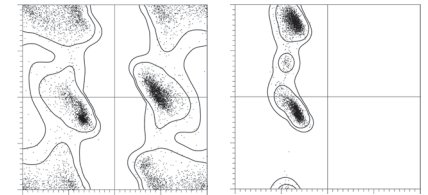


general residue Ramachandran plot



glycine

proline



plots adapted from Lovell S. C. *et al.* Structure validation by C<sub>α</sub> geometry: φ, ψ and C<sub>β</sub> deviation. *PROTEINS: structure, function, and genetics*. 2003;50(3):437–450.

Asn N NC(=O)CC(N)C(=O)O U C  
 Lys K CCCC[NH3+] A G  
 Ser S CC(O)C(=O)O G U  
 Arg R CCCNC(=[NH2+])N C C  
 Adenine NC1=NC=NC2=C1N=CN2

Ile I CC(C)C U C A  
 Met M CS G  
 Thr T CC(O)C C U C A G  
 Tyr Y CC1=CC=C(O)C=C1 U C A  
 (stop) A G  
 Cys C CC(S)C(=O)O U C C A  
 Trp W CC1=C(C2=CC=CC=C2N1)C3=CC=CC=C3 G U C  
 Phe F CC1=CC=CC=C1 U C  
 Leu L CC(C)C A G  
 Ser S CC(O)C(=O)O U C C A G  
 Uracil O=C1NC=CC(=O)N1

Asp D CC(=O)[O-] U C A  
 Glu E CC(=O)[O-] A G U  
 Val V CC(C)C U C A G  
 Val V CC(C)C U C A G  
 Leu L CC(C)C U C C A G  
 Leu L CC(C)C U C C A G  
 Cytosine NC1=NC(=O)NC=C1 U C C A G  
 Gly G CC(=O)O U C C A G  
 Ala A CC C U C C A G  
 Arg R CCCNC(=[NH2+])N U C C A G  
 Pro P C1CC[NH2+]C1 C U C C A G

Kevin Lynagh, dept. dirigible flightcraft

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