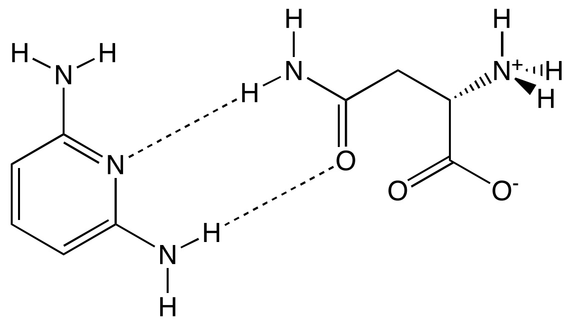
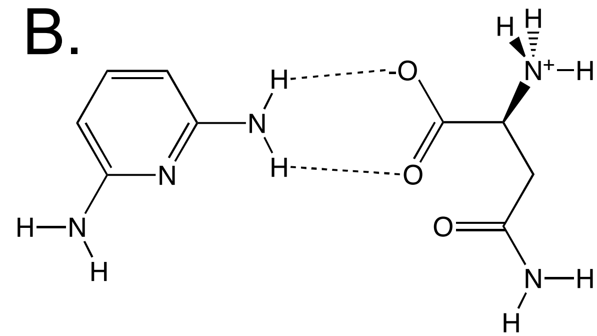
Which of these H-bonding Schemes is Satisfactory?

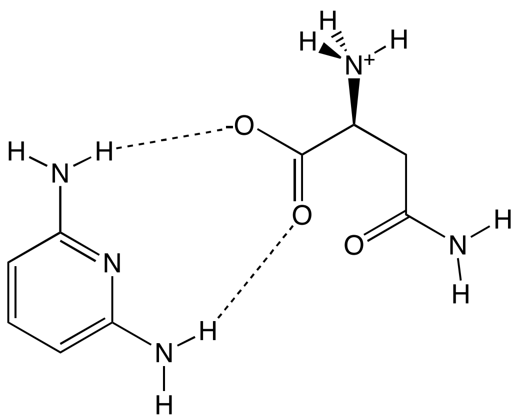
A.



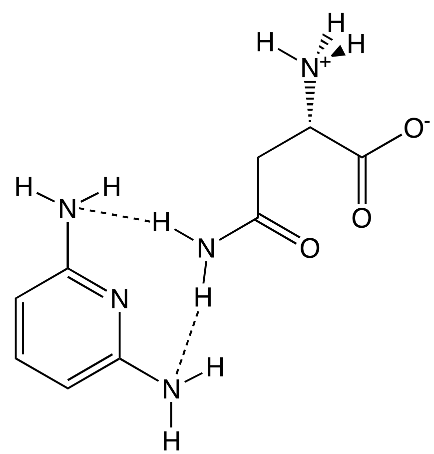
B.



C.



D.



Just to be sure of learning

Why doesn't hexane dissolve in water?

1. Hexane makes stronger enthalpic interactions with itself.

2. Water loses hydrogen bonds upon the dissolution of hexane.

3. The entropy of system increases when hexane and water separate from each other.

4. The entropy of the water molecules decreases when hexane is dissolved.

Jack Szostak (Nobel 2009, Medicine) argues for the primacy of lipids in the origins of life.

- ***Fatty acids*** *are present on meteorites and can be synthesized under pre-biotic conditions*
  ° D. W. Deamer, *Nature* **317**, 792 (1985).
  ° W. V. Allen & C. Ponnamperuma, *Curr. Mod. Biol.* **1**, 24 (1967).

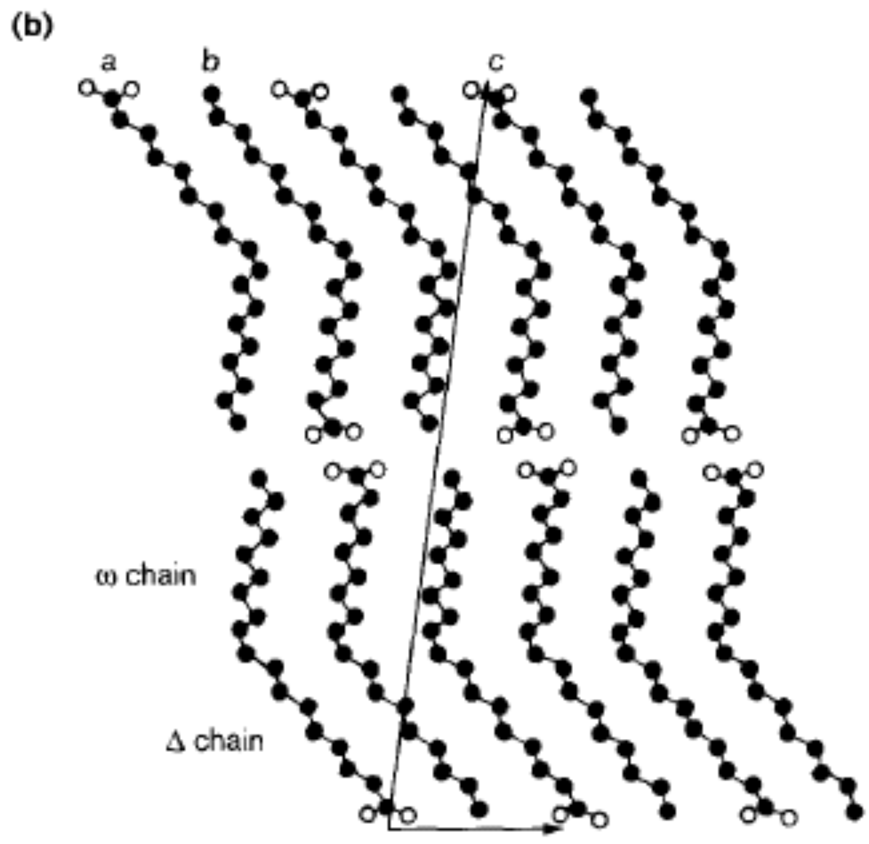
- *Fatty acids can spontaneously assemble into* ***vesicles*** *at moderate pH*
  ° J. M. Gebicki & M. Hicks, *Nature* **243**, 232 (1973).

- *Vesicles can grow and divide in the lab when "fed" fatty acid* ***micelles***
  ° M. M. Hanczyc, S. M. Fujikawa & J. W. Szostak, *Science* **302**, 618 (2003).

Melting Temps for Fatty Acids

Name	Symbol	T_m (K)	ΔH_{fus} (kcal/mol)	ΔS_{fus} (cal/mol•K)
Caprylic acid	8:0	289	6.2	21.5
Capric acid	10:0	305	6.7	22.0
Lauric acid	12:0	316	8.8	27.7
Myristic acid	14:0	327	10.8	33.2
Palmitic acid	16:0	335	10.1	30.0
Stearic acid	18:0	342	13.5	39.5
Oleic acid	$18:1_{n-9\ cis}$	286	9.5	34.5
Linoleic Acid	$18:2_{n-6}$	268		
Linolenic Acid	$18:3_{n-3}$	262		

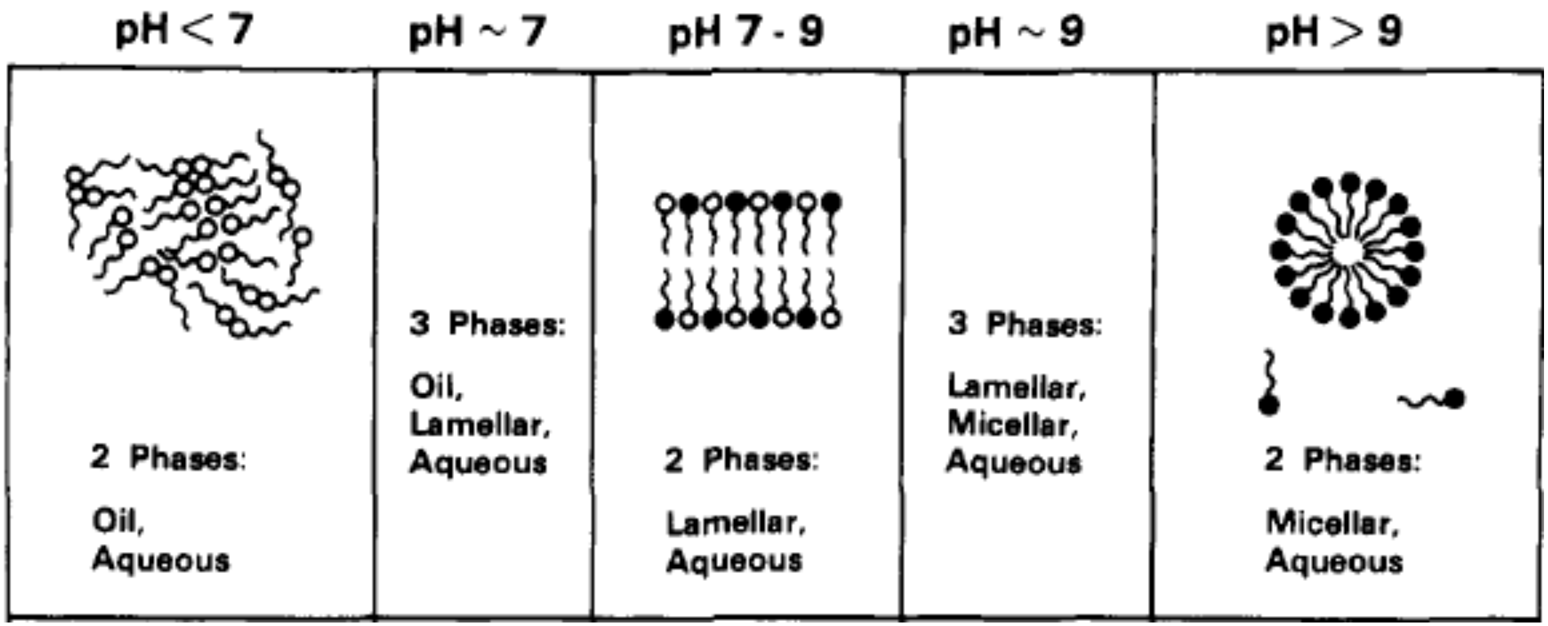
Oleic acid crystal



Thermodynamics of Micelle Formation

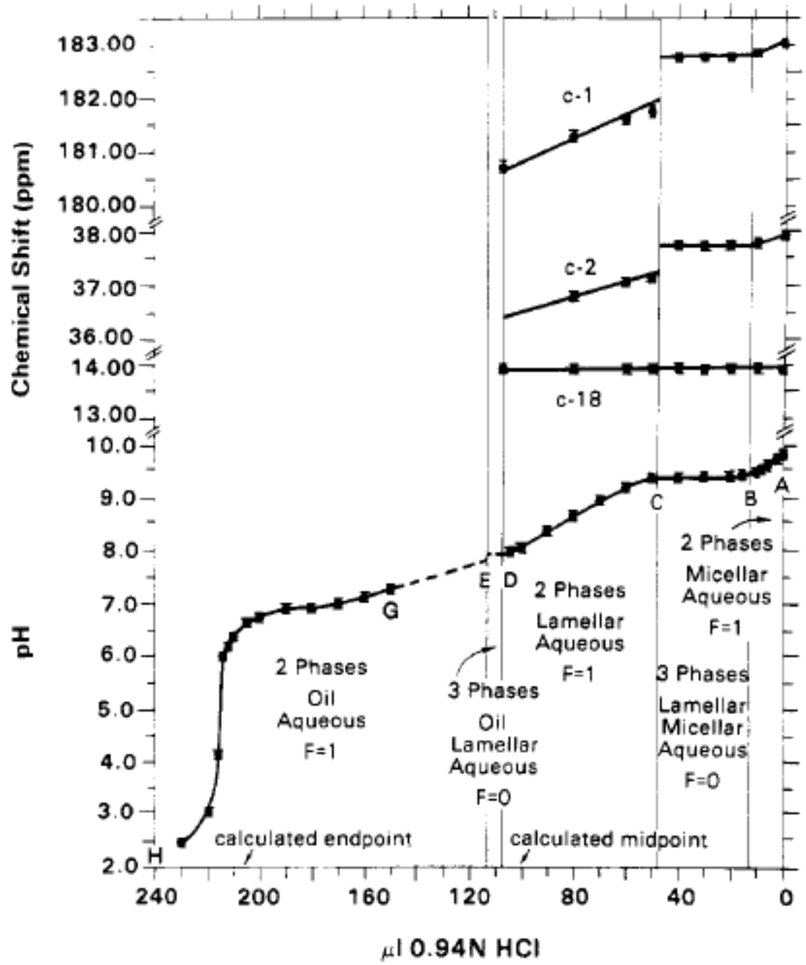
Amphiphile	cmc (μM)	ΔG_m° (kcal/mol)	ΔH_m° (kcal/mol)	$-T\Delta S_m^\circ$ (kcal/mol)
$CH_3(CH_2)_7OSO_3^-$	2300	-3.6	0.8	-4.4
$CH_3(CH_2)_9OSO_3^-$	590	-4.4	0.5	-4.9
$CH_3(CH_2)_{11}OSO_3^-$	150	-5.2	0.5	-5.7

pH Dependence of Fatty Acid Aggregation



Biochemistry **1988**, *27*, 1881–1888

pH Dependence of Fatty Acid Aggregation

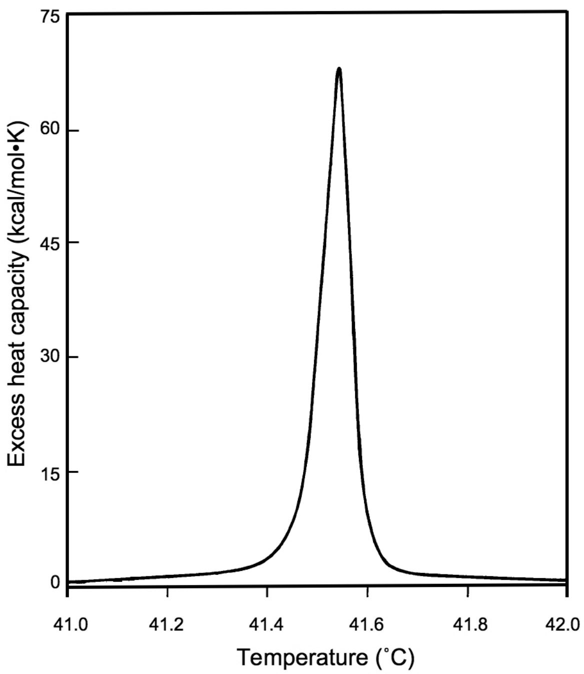


Biochemistry **1988**, *27*, 1881–1888

CMC vs. Head Group on Phospholipids

Head Group	cmc (mM)	ΔG° (kcal/mol)
PA^{2-} (pH 8)	0.77	-6.5
PAH^{-} (pH 5)	0.13	-7.6
PS^{-}	0.24	-7.2
PC	0.10	-7.7
PE	0.05	-8.1

Differential Scanning Calorimetry

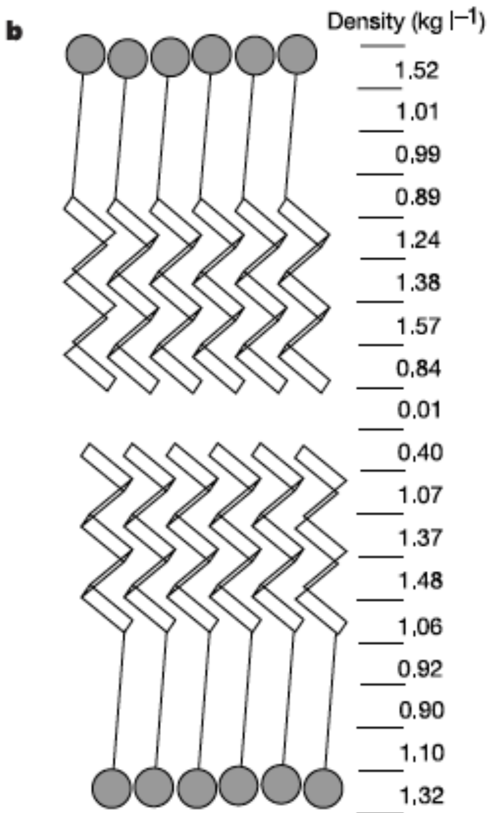


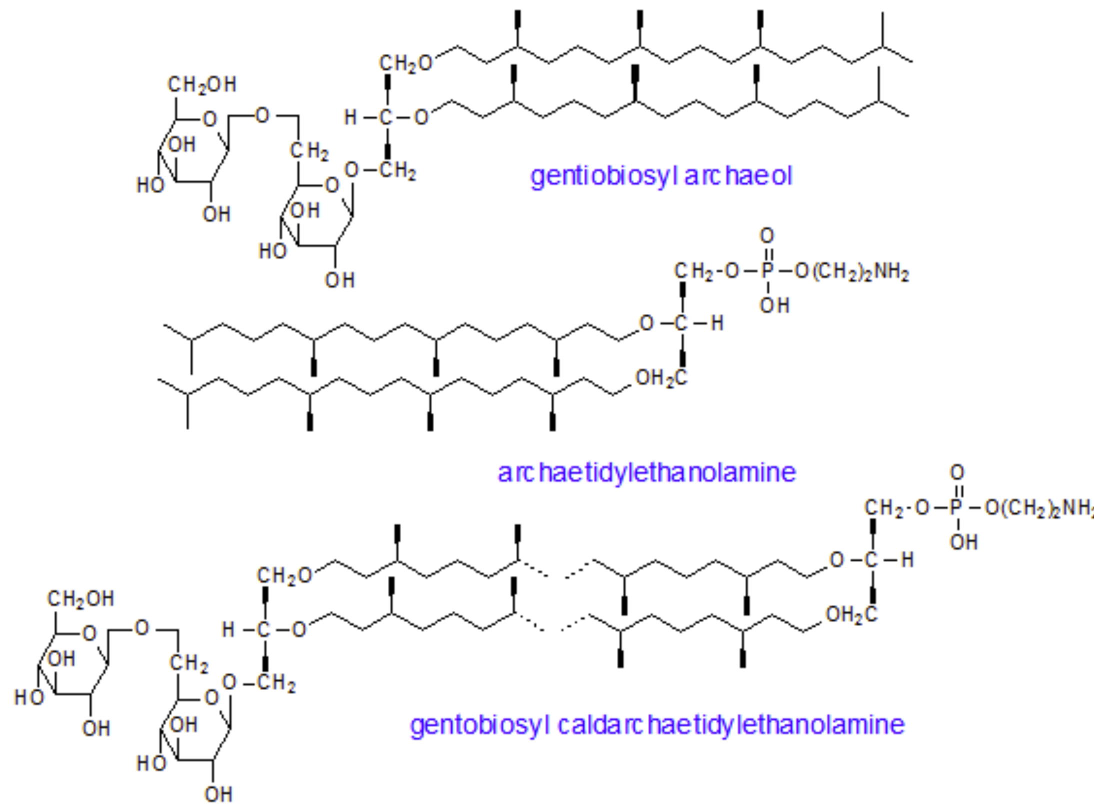
Differential scanning calorimetry scan of dipalmitoylphosphocholine in water. The transition temperature is 41.5˚C. (Figure adapted from Albon & Sturtevant (1978) *Proc. Natl. Acad. Sci. USA* **75**, 2258-2260).

Gel to Liquid Crystal Transition in Lipid Bilayers

Phospholipid	T_m (˚C)	ΔH_m° (kcal/mol)	ΔS_m° (cal/mol•K)
Dimyristoyl PC	24.0	6.5	21.9
Dipalmitoyl PC	41.5	8.7	27.7
Distearoyl PC	54.3	10.4	33.3
Diarachidoyl PC	64.1	12.3	37.6
Dimyristoyl PE	49.9	6.6	20.4
Dipalmitoyl PE	63.9	8.6	25.5
Distearoyl PE	70.4	10.5	30.6
Diarachidoyl PE	81.1	12.2	34.5
1-stearoyl-2-oleoyl PC	3.8	6.5	23.3

Funky Lipids





Ladderanes
Annamoxasome
Nature (2002) **419**, 708

Ether phosopholipids
In archaea
http://lipidlibrary.aocs.org/Lipids/archaea