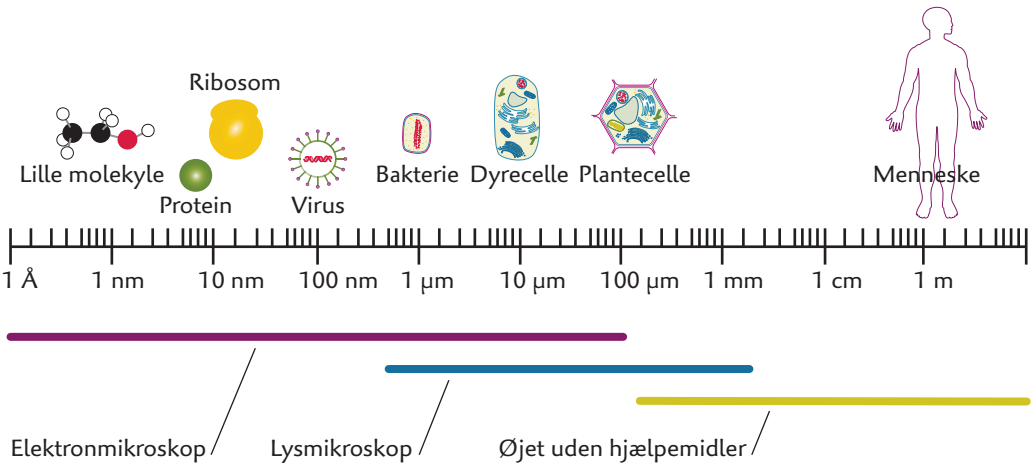


| | | |
|---|---|---|
| cm | = | $10^{-2}$ m |
| mm | = | $10^{-3}$ m |
| µm | = | $10^{-6}$ m |
| nm | = | $10^{-9}$ m |
| Å | = | $10^{-10}$ m |

Figur 2. Forskellige cellers størrelse.

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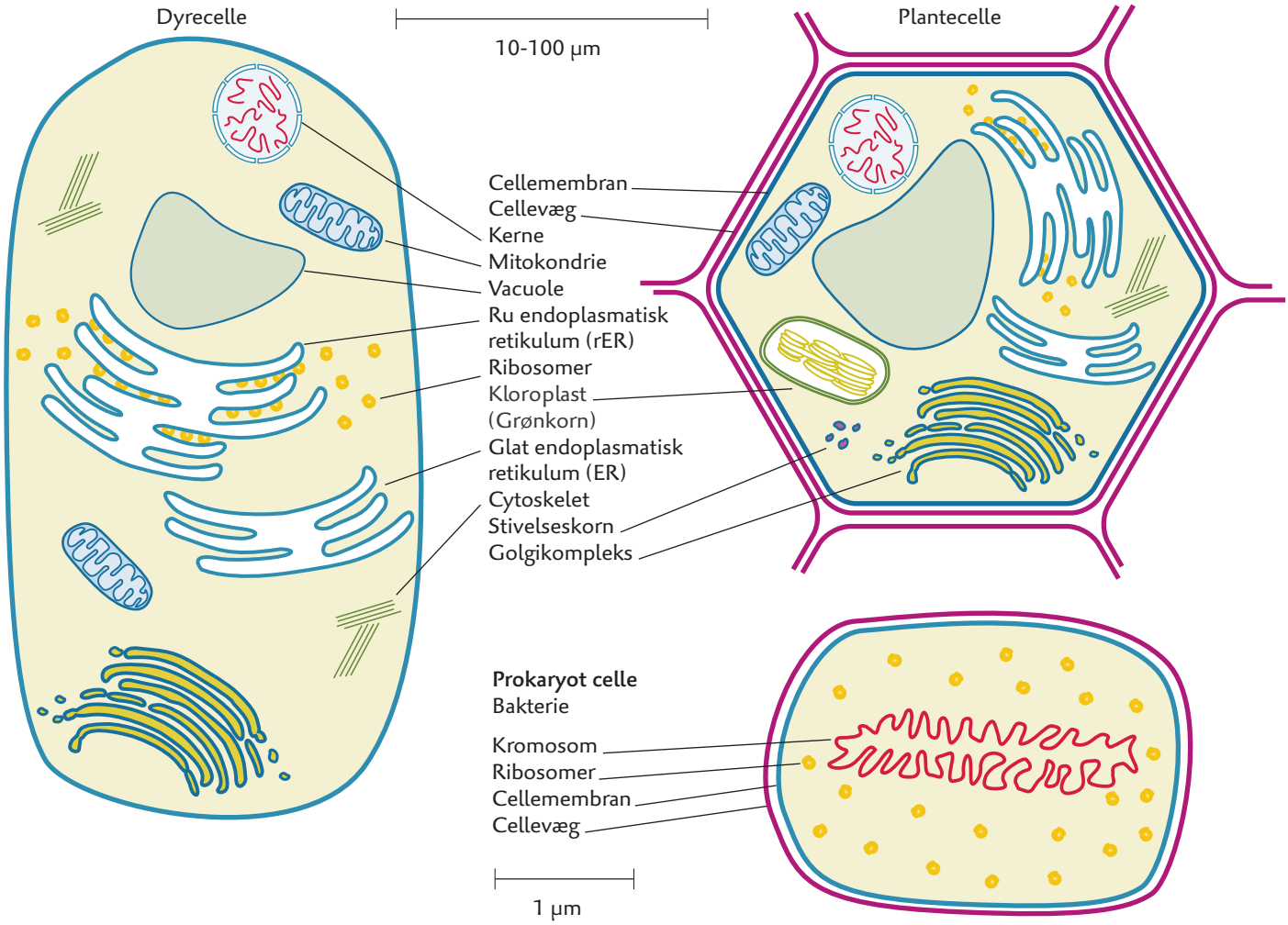


Figur 3. Plante-, dyre- og bakteriecelle. Se skema på næste side.

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Illustration: Elin Steffensen, Gigraf · ISBN 978-87-90363-43-7.

| Organel | Funktion |
|---|---|
| Vakuole | Membranafgrænset hulrum i cellens cytoplasma. Regulerer plantecellens saftspænding. Vakuolen udgør ofte størstedelen af plantecellens volumen |
| Mitokondrier | Dobbeltmembranbeklædte organeller der laver respiration og dermed danner cellens energi i form af ATP. Indeholder sit eget DNA |
| Stivelseskorn | Vesikler med oplagringsnæring i form af polysaccharid |
| Cellekerne | Kaldes også nukleus. Indeholder cellens arvemateriale i form af DNA der er ordnet i kromosomer |
| Glat ER | Glat endoplasmatisk retikulum er et membransystem hvor der dannes membranlipider samt fx steroidhormoner, der udskilles fra cellen |
| Cytoplasma | Vandig substans mellem kerneområdet og cellemembranen. Cytoplasma indeholder cellens organeller samt diverse organiske og uorganiske forbindelser vedrørende cellens stofskifte |
| Cellemembran | Dobbeltlipidlag med membranproteiner. Afgrænser cellens indre og regulerer transporten af stoffer gennem membranen |
| Cellevæg | Består hos planter primært af polysaccharіderne cellulose og hemicellulose samt lignin og har afstivende funktion. Hos svampe består den oftest af chitin som er et polysaccharid sammensat af acetyl-glucosaminenheder. Bakterier har cellevægge af peptidoglycan der en en blanding af carbohydrater og aminosyrer |
| Kloroplaster | Kaldes også grønkorn og er cellens fotosynteseorganeller. Indeholder det grønne pigment klorofyl der kan omdanne energi fra lys til kemisk energi bundet i glucose. Indeholder sit eget DNA |
| Golgikompleks | Transportorgan i cellen så forskellige forbindelser pakkes i vesikler og sendes rundt i cellen eller tømmes ud af cellen. Golgikompleks er et membransystem der pakker fx proteiner fra ER i vesikler der skal ud til cellemembranen |
| Ru ER med ribosomer | Det ru endoplasmatiske retikulum er et membransystem hvor proteiner modificeres og glycosyleres, dvs. tilkobles carbohydrat |
| Ribosomer | Ribosomer består af protein og RNA. Danner cellens proteiner via proteinsyntesen |
| Cytoskelet | Cytoskelettet består af protein. Det har afstivende funktion og har betydning for transport af stoffer inde i cellen |

Figur 3. Organellernes funktion.
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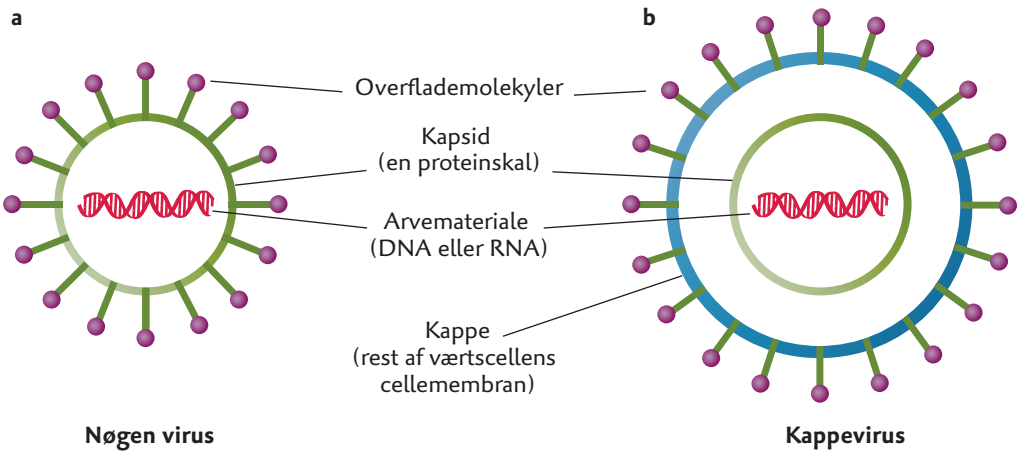


Figur 4. Opbygningen af en virus.
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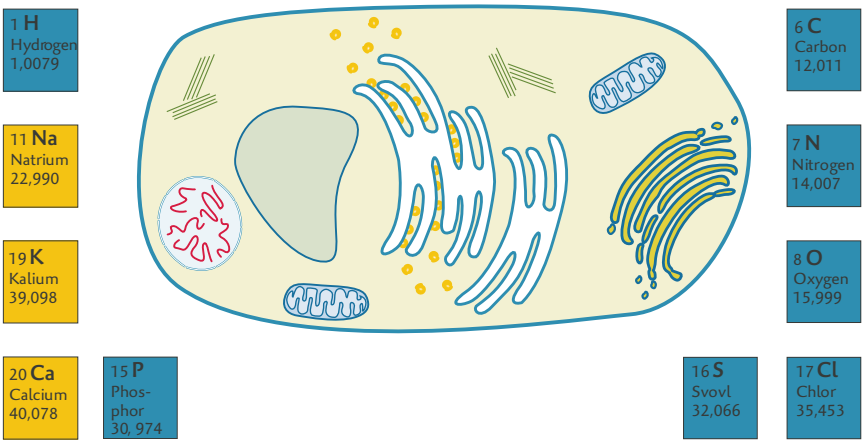


Figur 5. Hyppigt forekommende grundstoffer i celler.

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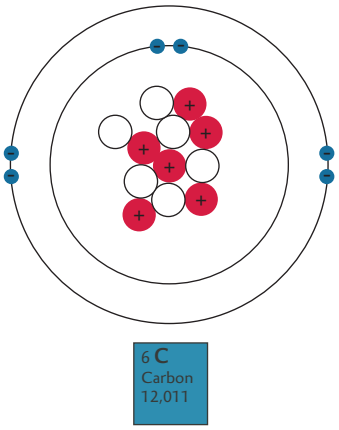


Figur 6. Model af carbonatom med elementarpartikler.
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| | Antal protoner | Antal neutroner | Atommasse | Hyppighed |
|---|---|---|---|---|
| $^{12}C$ | 6 | 6 | 12 | 98,93 % |
| $^{13}C$ | 6 | 7 | 13 | 1,07 % |
| $^{14}C$ | 6 | 8 | 14 | Forsvindende lille del |

Figur 7. Oversigt over carbonisotoper.
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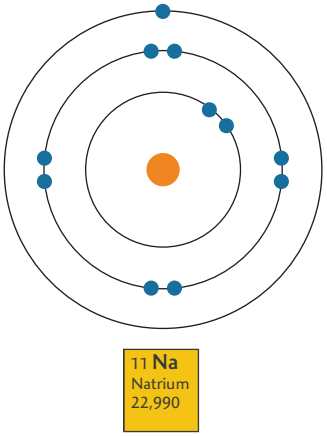


Figur 8. Model af natriumatom.

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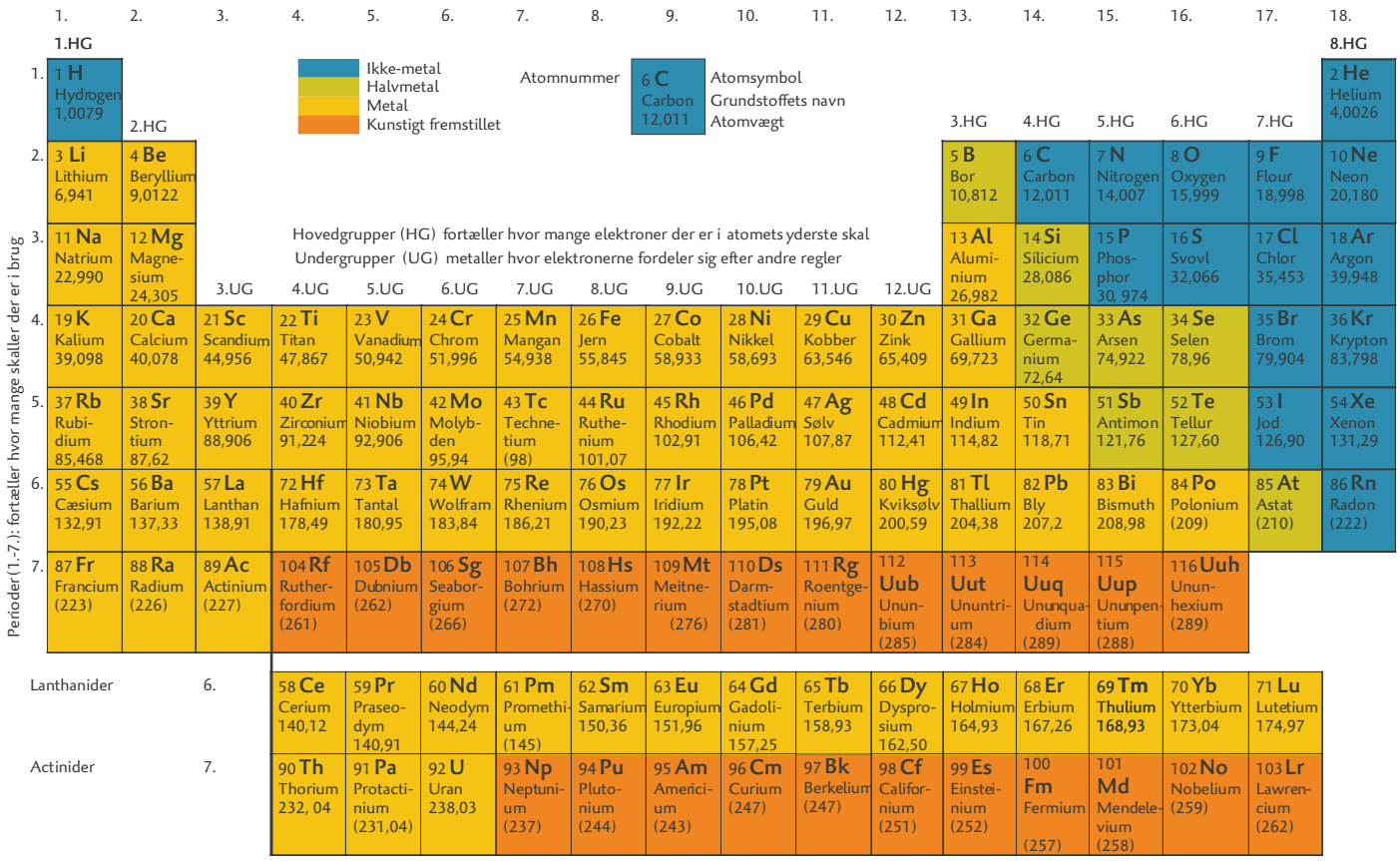


Figur side 13, det periodiske system.

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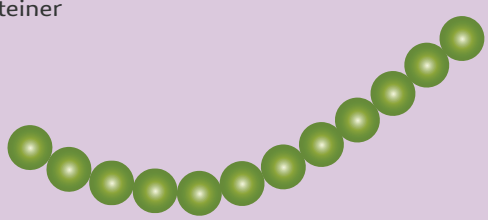
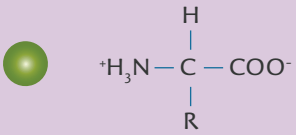
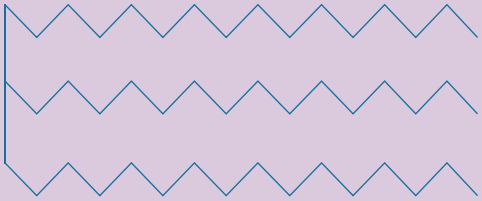
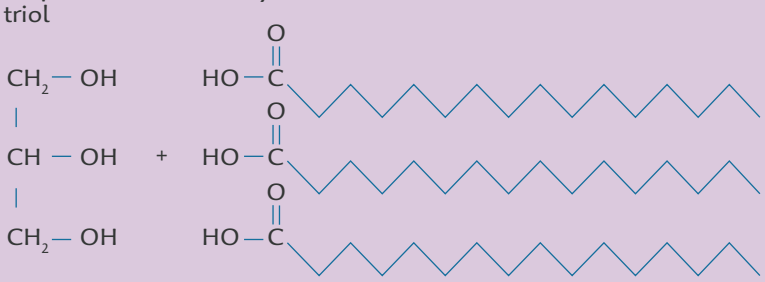
Illustration: Elin Steffensen, Gigraf · ISBN 978-87-90363-43-7.

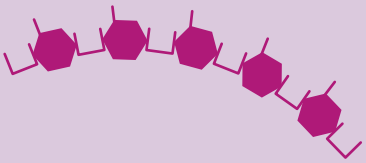
| Stofklasse | Grundenheder |
| --- | --- |
| Proteiner | Aminosyrer |
| Lipider | Propan-1,2,3-triol + Fedtsyrer |
| Carbohydrater | Monosaccharider |
| Nucleinsyrer | Nucleotider |

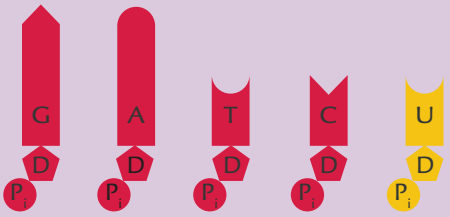







Figur 9. Cellens molekyler.

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| Organiske stoffer |
| --- |
| Carbohydrater |
| Proteiner |
| Lipider |
| DNA |
| RNA |
| **Uorganiske stoffer** |
| $H_2O$ |
| $CO_2$ |
| $O_2$ |
| $Na^+$, $K^+$, $Ca^{2+}$, $Cl^-$ |
| $H_2PO_4^-$, $HPO_4^{2-}$ |
| $HCO_3^-$ |

Figur 10. Eksempler på organiske og uorganiske stoffer i celler.
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Illustration: Birthe Møller Nielsen · ISBN 978-87-90363-43-7.

| Tal | Talord på græsk |
|---|---|
| 1 | mono |
| 2 | di |
| 3 | tri |
| 4 | tetra |
| 5 | penta |
| 6 | hexa |
| 7 | hepta |
| 8 | octa |
| 9 | nona |
| 10 | deca |

Figur 11. De græske talord
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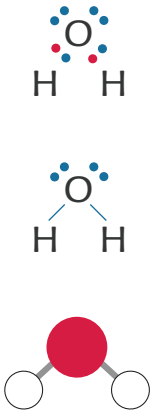


Figur 12. Vandmolekylets opbygning.
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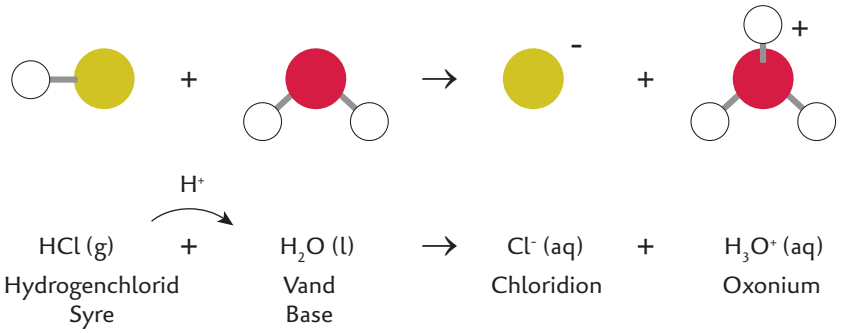


Figur 13. Syre-basereaktion.
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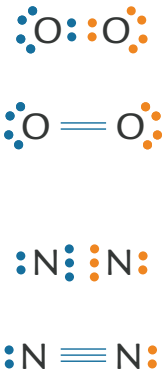


Figur 14. Dioxygen og dinitrogen.
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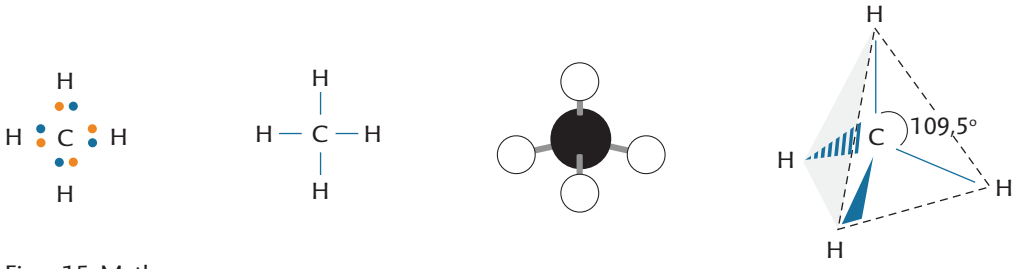


Figur 15. Methan.
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| Ioner | Koncentration (mmol/L) |
|---|---|
| $Na^+$ | 15 |
| $K^+$ | 120-150 |
| $Mg^{2+}$ | 43 |
| $Cl^-$ | 3 |
| $HCO_3^-$ | 10 |
| $H_2PO_4^-/HPO_4^{2-}$ | 95 |
| $SO_4^{2-}$ | 20 |

Figur 16. Ioner i celler.
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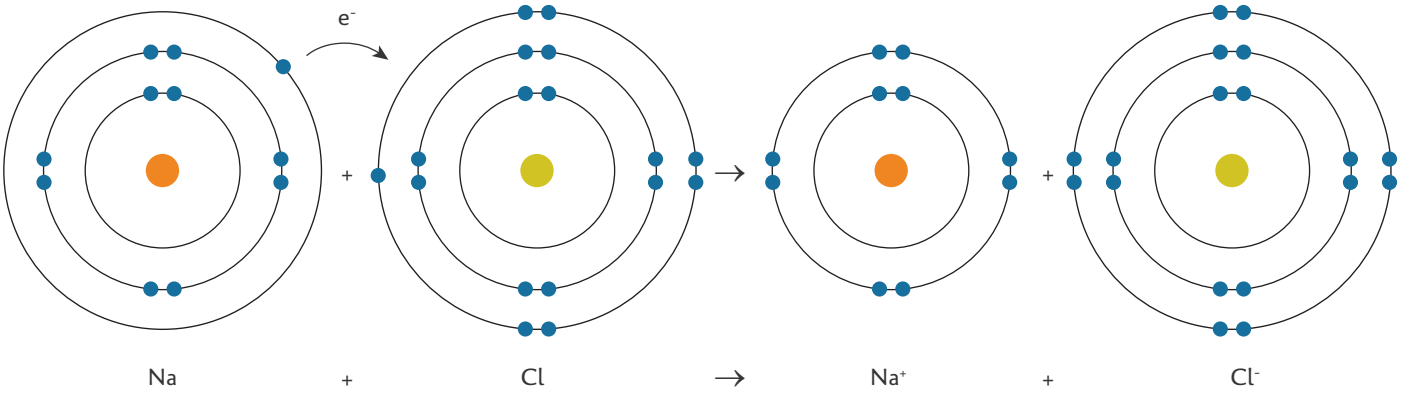


Figur 17. Elektronoverførsel.
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| Kemisk formel | Navn |
|---|---|
| $Ca^{2+}$ | Calciumion |
| $Fe^{2+}$ | Jern(II)ion |
| $Fe^{3+}$ | Jern(III)ion |
| $H^{+}$ | Hydron |
| $K^{+}$ | Kaliumion |
| $Mg^{2+}$ | Magnesiumion |
| $Na^{+}$ | Natriumion |
| $Cl^{-}$ | Chloridion |

| Kemisk formel | Navn |
|---|---|
| $H_3O^{+}$ | Oxonium |
| $NH_4^{+}$ | Ammonium |
| $HCO_3^{2-}$ | Hydrogencarbonat |
| $CO_3^{2-}$ | Carbonat |
| $OH^{-}$ | Hydroxid |
| $PO_4^{3-}$ | Phosphat |
| $HPO_4^{2-}$ | Hydrogenphosphat |
| $H_2PO_4^{-}$ | Dihydrogenphosphat |
| $SO_4^{2-}$ | Sulfat |

Figur 18. Enatomige og fleratomige ioner.

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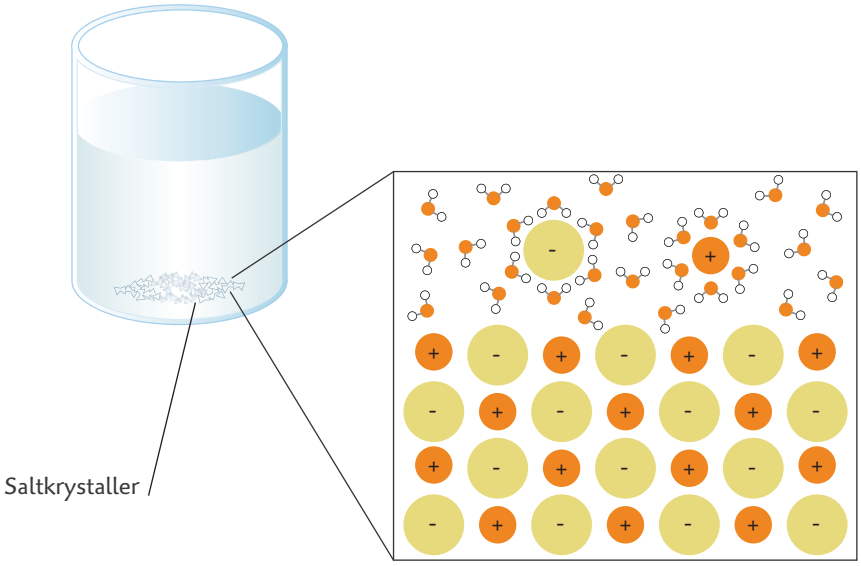


Figur 19. Hydratiserede ioner ved opløsning af NaCl i vand.
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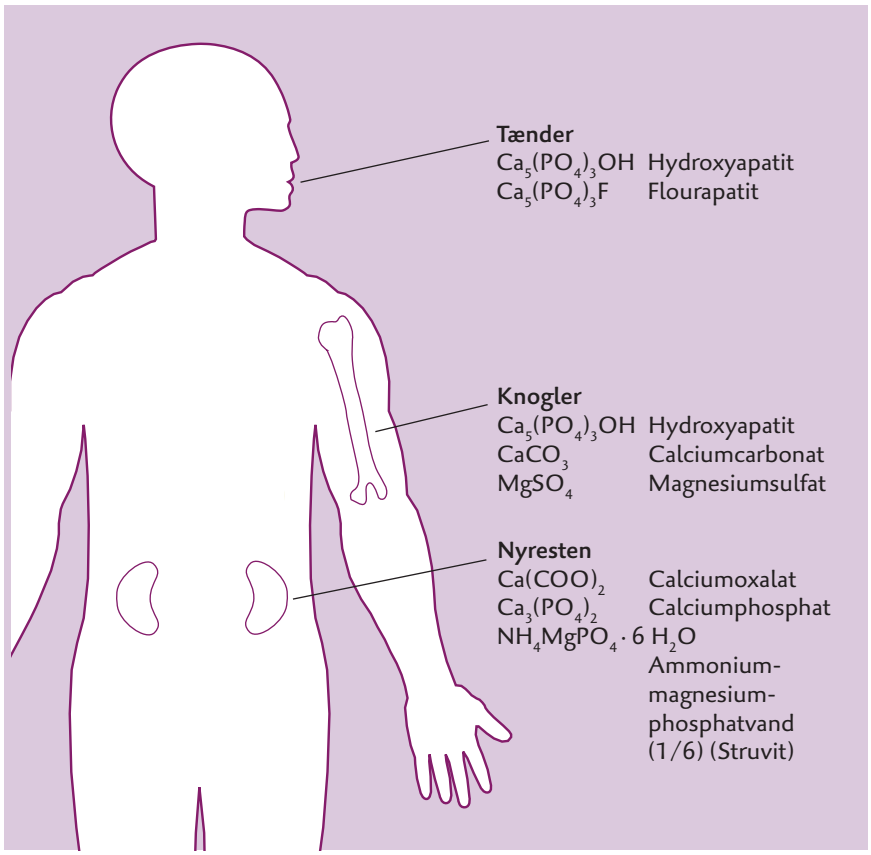


Figur 20. Eksempler på tungtopløselige salte i kroppen.

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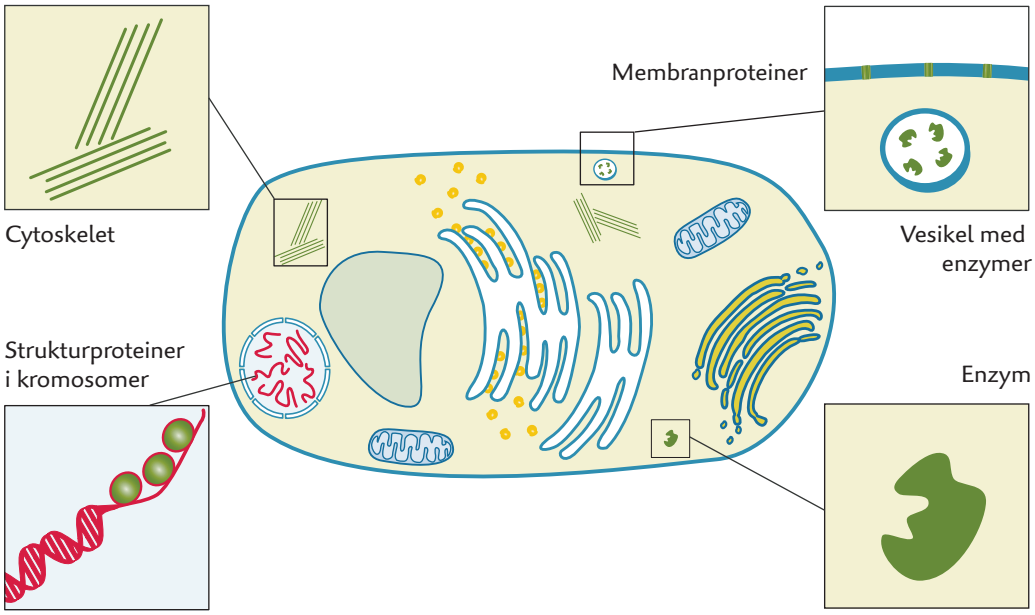


Figur 21. Dyrecelle hvor proteiner er fremhævet.
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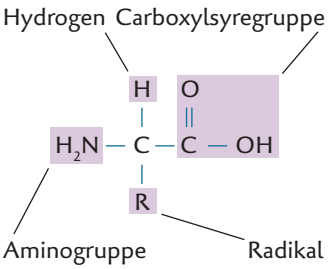


Figur 22. Aminosyrers opbygning.
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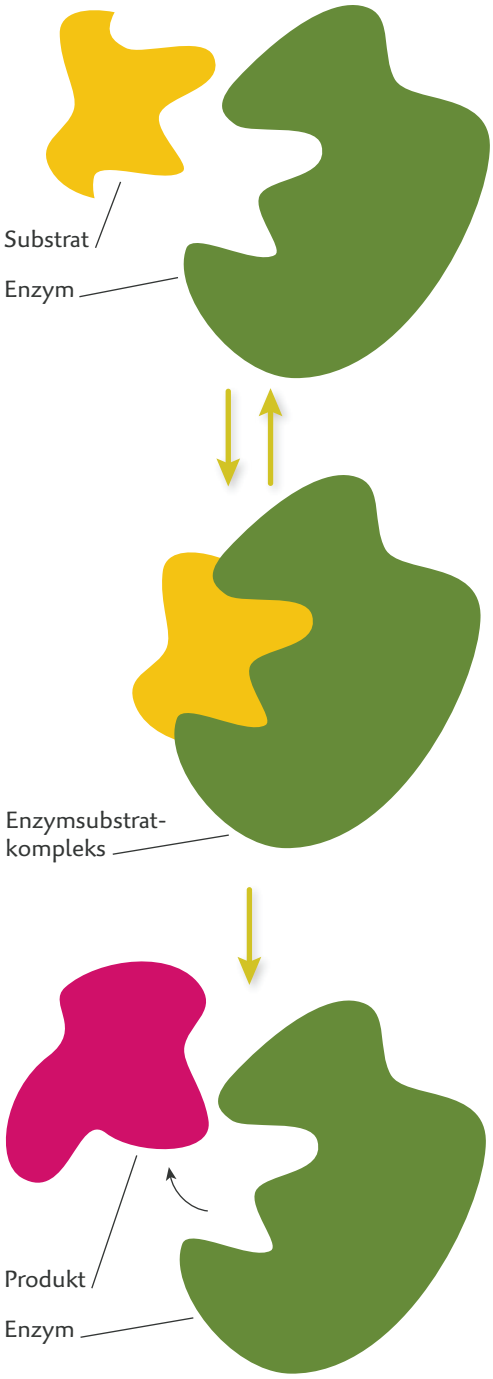


Figur 23. Enzymers funktion.
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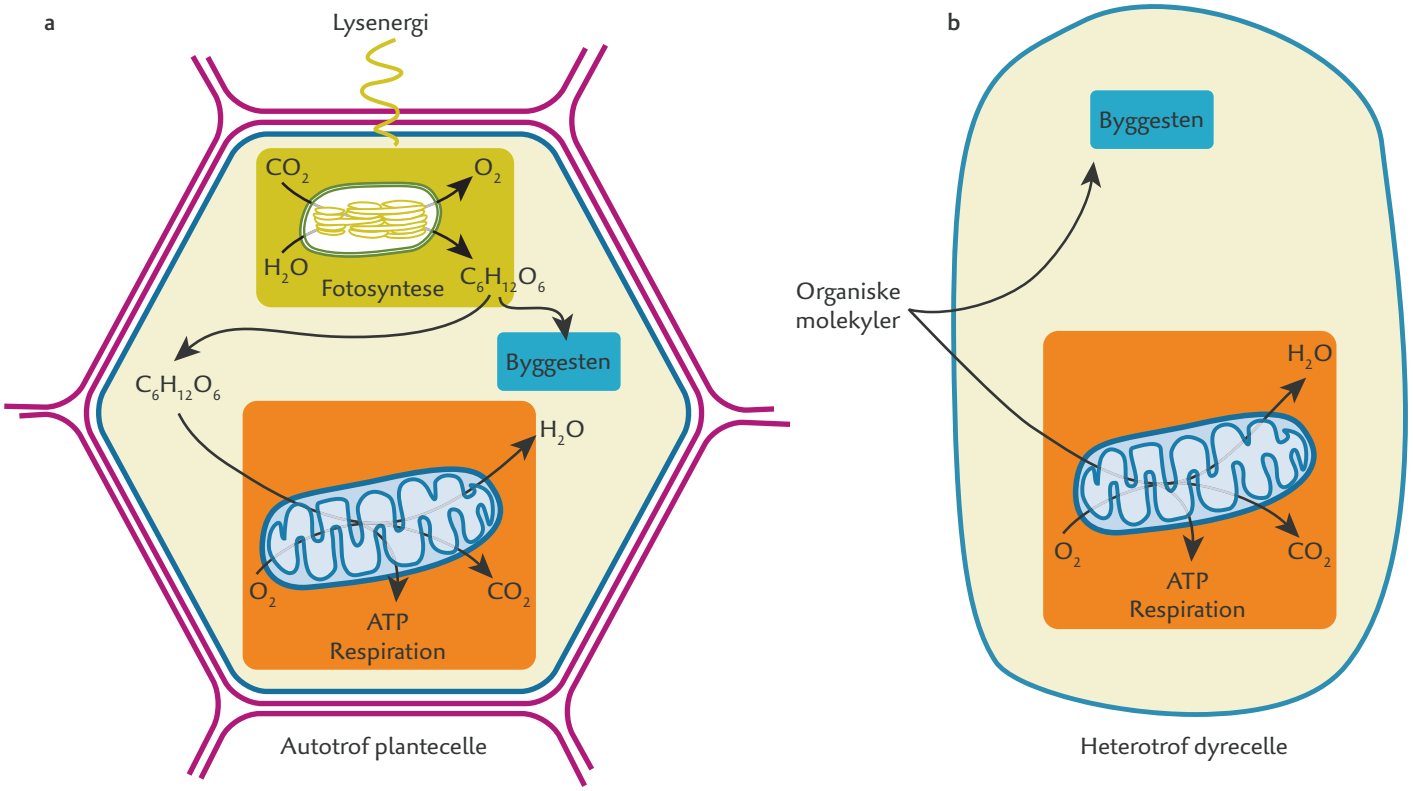


Figur 24. Autotrof og heterotrof levevis.
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Illustration: Elin Steffensen, Gigraf · ISBN 978-87-90363-43-7.

| Bakterietype | Reaktion | Energigevinst | Kommentar |
|---|---|---|---|
| Fx *Nitrosomonas* | $NH_3 + 1½\ O_2 \rightarrow H^+ + NO_2^- + H_2O$<br>Ammoniak oxideres til nitrit | 287 kJ/mol | Den vundne energi bruges til at danne organisk stof ud fra $CO_2$ |
| Fx *Nitrospira* | $NO_2^- + ½\ O_2 \rightarrow NO_3^-$<br>Nitrit oxideres til nitrat | 76 kJ/mol | |

Figur 25. Nitrifikation.
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| Na | K | Mg | Ca | C | P | N | H | S | Cl | O |
|---|---|---|---|---|---|---|---|---|---|---|
| 0,9 | 0,8 | 1,2 | 1,0 | 2,5 | 2,1 | 3,0 | 2,1 | 2,5 | 3,0 | 3,5 |

Figur 26. Elektronnegativitetsværdier for udvalgte grundstoffer.
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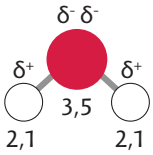
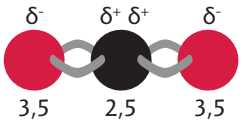
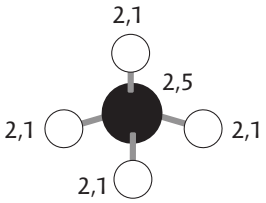
Dioxygen, $O_2$




Vand, $H_2O$




Carbondioxid, $CO_2$




Methan, $CH_4$

Figur 27. Vandmolekylmodeller.

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| Grundstoffer | Metal og ikke-metal | To ikke-metaller | To ikke-metaller |
|---|---|---|---|
| Bindingstype | Ionbinding | Polær elektronparbinding | Upolær elektronparbinding |
| Karakteristik | Ikke-metalatomet modtager en eller flere elektroner fra metalatomet | Der er ikke ligelig fordeling af de bindende elektroner | Der er ligelig fordeling af de bindende elektroner |
| Forskel i EN-værdi | Over 1,8 | 0,5-1,8 | 0-0,5 |
| Eksempel | $K^+ Cl^-$ | H-Cl | O=O |

Figur 28. Oversigt over bindingstyper.
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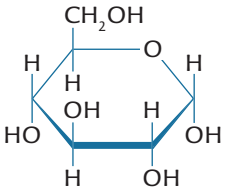
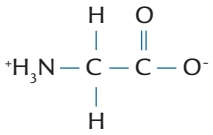
Glucose




Aminoethansyre (glycin)




Figur 29. Glucose og aminoethansyre.

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| Navn | Strukturformel | Opløselighed g/100 mL vand |
|---|---|---|
| Methanol | $CH_3-O-H$ | * |
| Ethanol | $CH_3-CH_2-O-H$ | * |
| Propan-1-ol | $CH_3-CH_2-CH_2-O-H$ | * |
| Butan-1-ol | $CH_3-CH_2-CH_2-CH_2-O-H$ | 7,4 |
| Pentan-1-ol | $CH_3-CH_2-CH_2-CH_2-CH_2-O-H$ | 2,7 |
| Hexan-1-ol | $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-O-H$ | 0,6 |

Figur 30. Opløselighed af alkoholer ved 20 °C.

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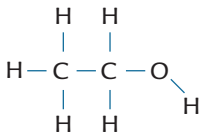
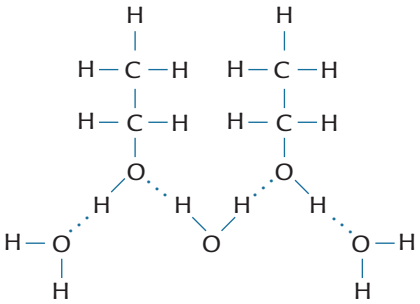
a



b



Figur 31. a. Ethanolmolekyle. b. To ethanolmolekyler.
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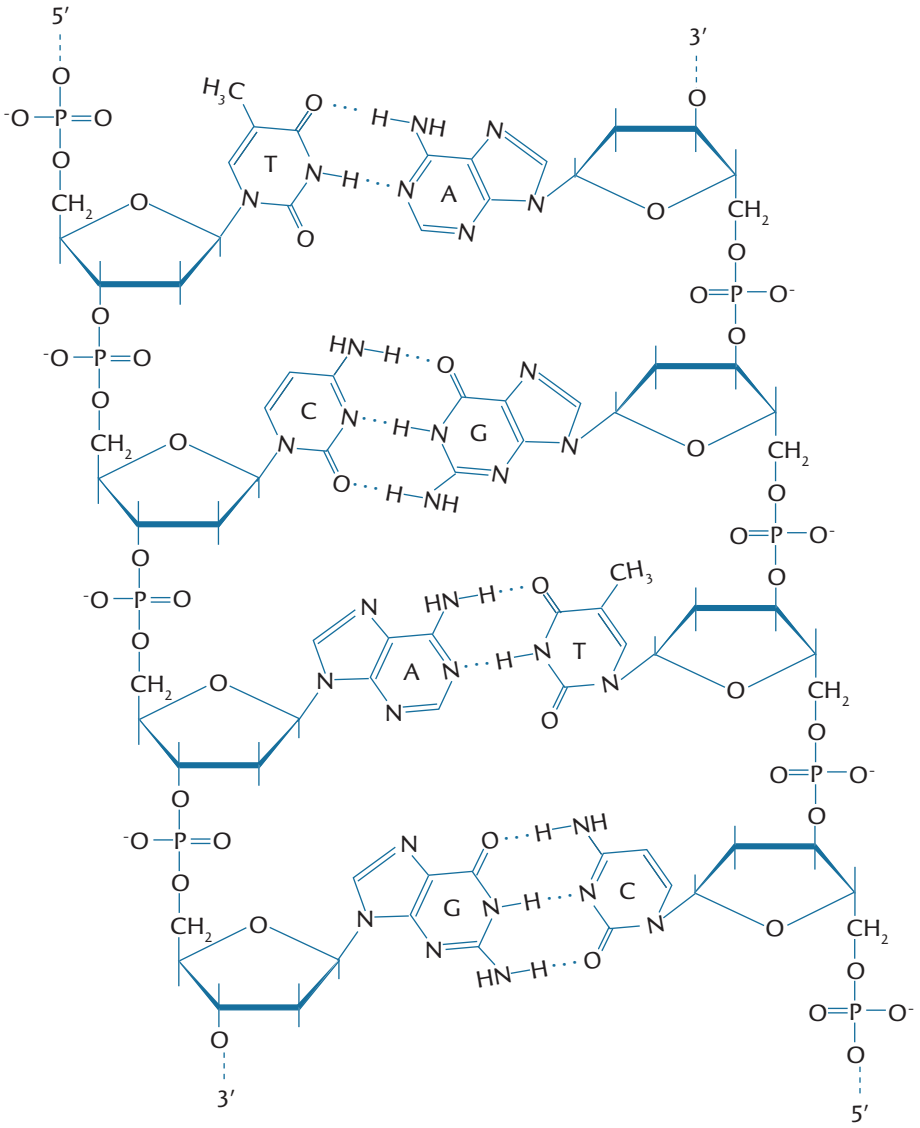


Figur 32. Hydrogenbindinger i DNA.

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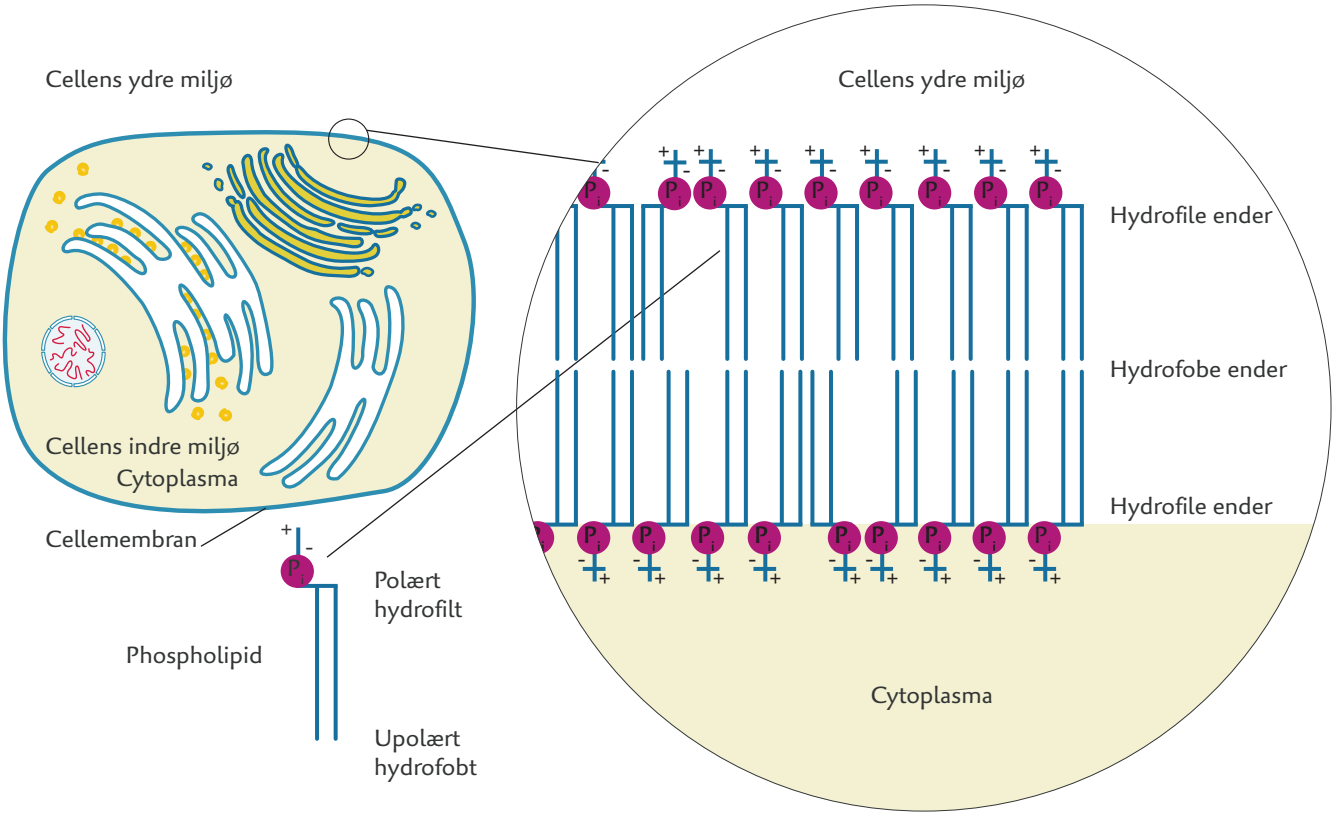


Figur 33. Cellemembranens opbygning.
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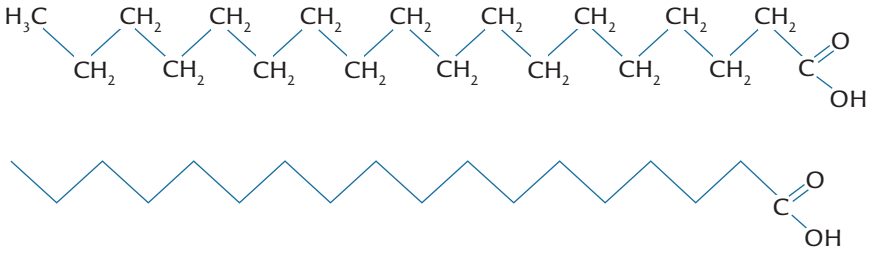





Figur 34. Octadecansyre.

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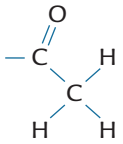


Figur 35. Ethanoylgruppe.
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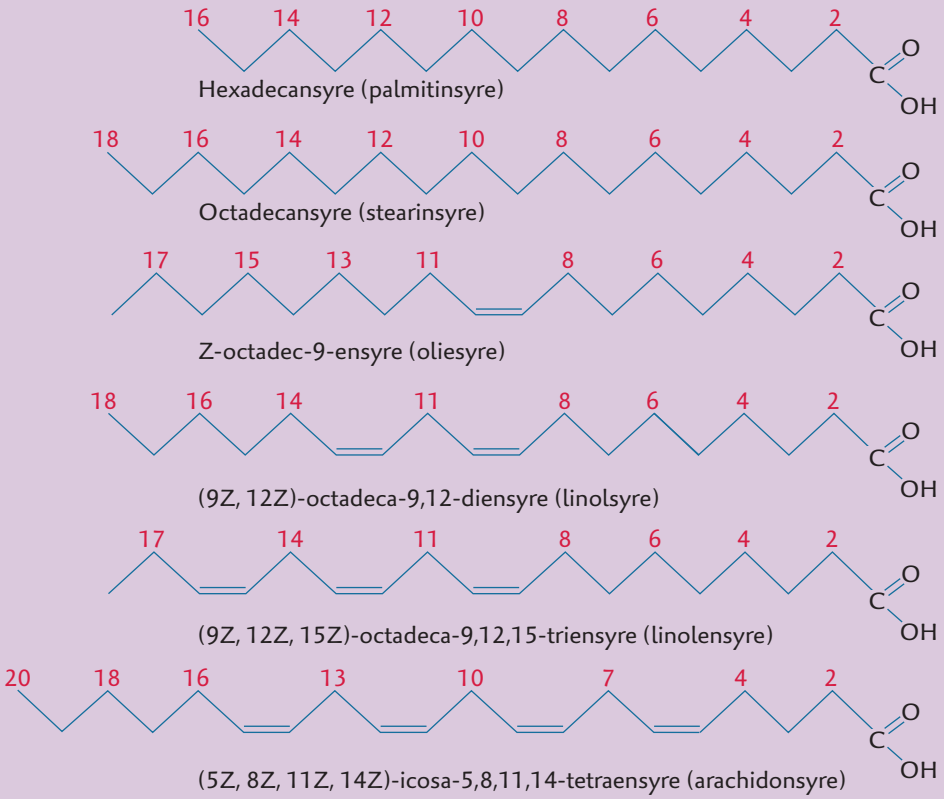
| Fedtsyre | Smeltepunkt °C |
|---|---|
|  | |



Figur 36. Eksempler på mættede og umættede fedtsyrer.

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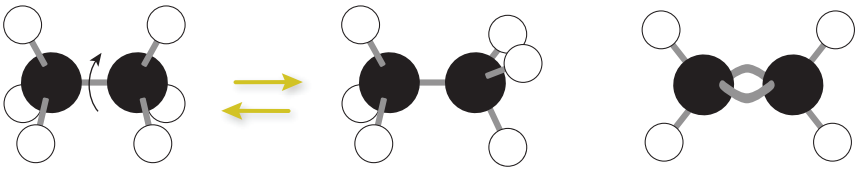

Figur 37. Carbonhydrider med enkelt- og dobbeltbindinger.
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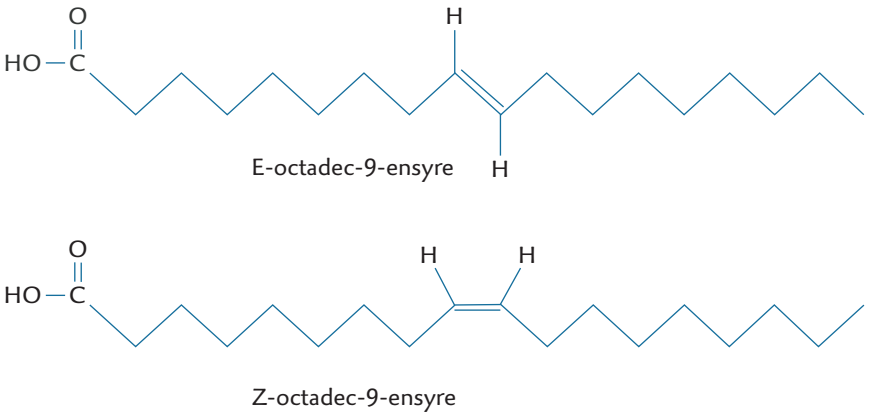


Figur 38. Isomere former af octadec-9-ensyre.
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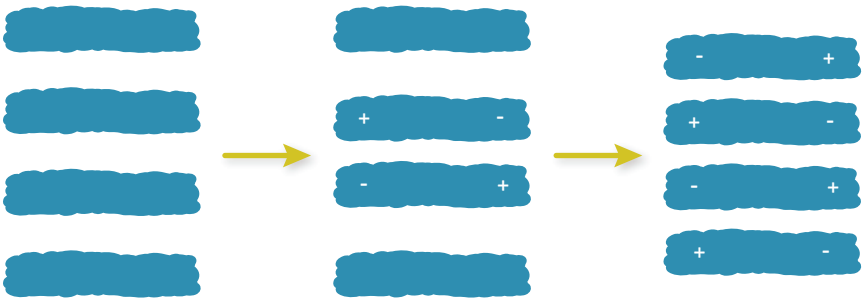
Illustration: Elin Steffensen, Gigraf · ISBN 978-87-90363-43-7.




Figur 39. Nabomolekyler kan påvirke hinandens elektronsystemer.
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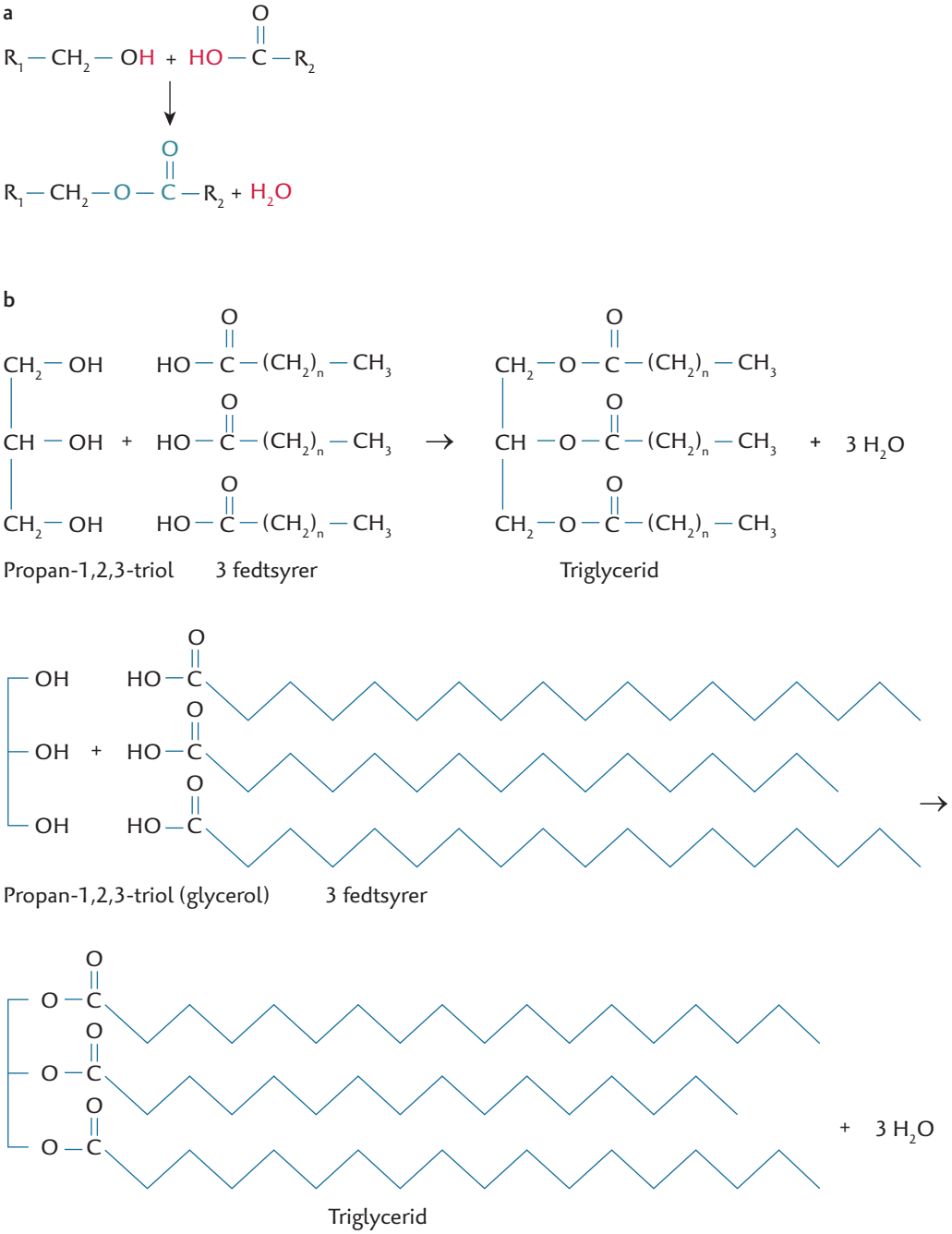


Figur 40. a. Kondensationsreaktion. b. Dannelse af triglycerid.

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| Levnedsmiddel | | Rejer | Torsk, filet, rå | Makrel, rå | Kylling, kød og skind, rå | Svinekød uspecificeret ca. 20 % fedt, råt | Lammekød uspecificeret, råt | Oksekød uspecificeret middelfedt, råt |
|---|---|---|---|---|---|---|---|---|
| Masseprocent af fedt | | 0,88 | 0,4 | 22,6 | 10,8 | 17,6 | 27,7 | 13,2 |
| Fedtsyrer: | | | | | | | | |
| C 12:0 laurinsyre | dodecansyre | | | | 0,2 | | | |
| C 14:0 myristinsyre | tetradecansyre | | | 6,9 | 0,9 | 1,7 | 5,5 | 3,2 |
| C 16:0 palmitinsyre | hexadecansyre | 22,2 | 33,1 | 16,3 | 22,9 | 26,1 | 24,8 | 27,0 |
| C 18:0 stearinsyre | octadecansyre | | | 2,9 | 6,3 | 13,3 | 21,4 | 13,0 |
| **Mættede fedtsyrer i alt** | | **22,2** | **33,1** | **26,1** | **30,3** | **41,1** | **51,7** | **43,2** |
| C 16:1 palmitolsyre | (Z)-hexadec-9-ensyre | 11,1 | | 3,6 | 6,0 | 3,3 | 1,3 | 6,3 |
| C 18:1 oliesyre | (Z)-octadec-9-ensyre | 11,1 | | 17,9 | 37,7 | 42,2 | 39,1 | 42,0 |
| C 20:1 gadolsyre | (Z)-icosa-11ensyre | 11,1 | | 8,2 | 1,1 | 1,1 | | |
| C 22:1 erucasyre | (Z)-docos-13-ensyre | | | 13,5 | | | | |
| **Monoumættede fedtsyrer i alt** | | **33,3** | | **43,2** | **44,8** | **46,6** | **40,4** | **48,3** |
| C 18:2 linolsyre | (9Z,12Z)-octadeca-9,12-diensyre | | | 3,6 | 21,0 | 8,9 | 2,6 | 2,0 |
| C 18:3 linolensyre | (9Z,12Z,15Z)-octadeca-9,12,15-triensyre | | | 1,3 | 1,0 | 1,1 | 2,6 | 1,3 |
| C 20:4 arakidonsyre | (5Z,8Z,11Z,14Z)-icosa-5,8,11,14-diensyre | | | | 0,6 | | | 1,0 |
| C 20:5 eicosapentaensyre | (5Z,8Z,11Z,14Z,17Z)-eicosa-5,8,11,14,17-pentensyre | 22,2 | 33,1 | 5,4 | 0,1 | | | |
| C 22:6 docosahexaensyre | (4Z,7Z,10Z,13Z,16Z,19Z)-docosa-4,7,10,13,16,19-hexensyre | 22,2 | 33,1 | 14,5 | 0,2 | | | |
| **Polyumættede fedtsyrer i alt** | | **44,4** | **66,2** | **24,8** | **22,9** | **10,0** | **5,2** | **4,3** |
| Andre fedtsyrer | | 0,1 | 0,7 | 5,9 | 2,0 | 2,3 | 2,7 | 4,2 |

Figur 41. Sammensætning af fedtsyrer i forskellige animalske produkter.
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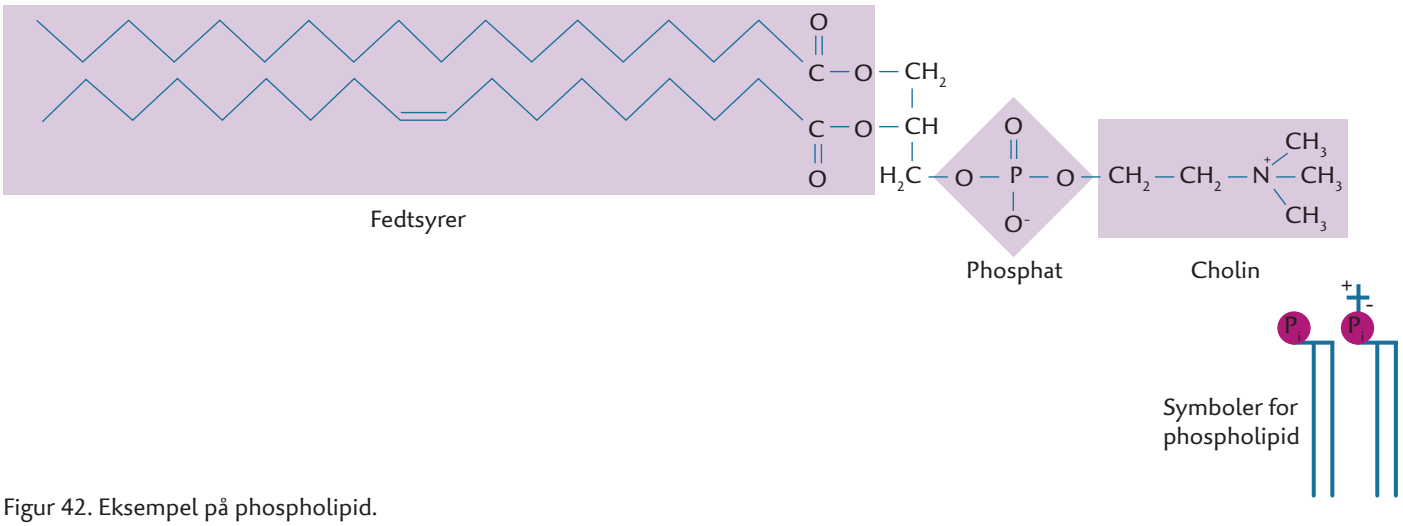


Figur 42. Eksempel på phospholipid.

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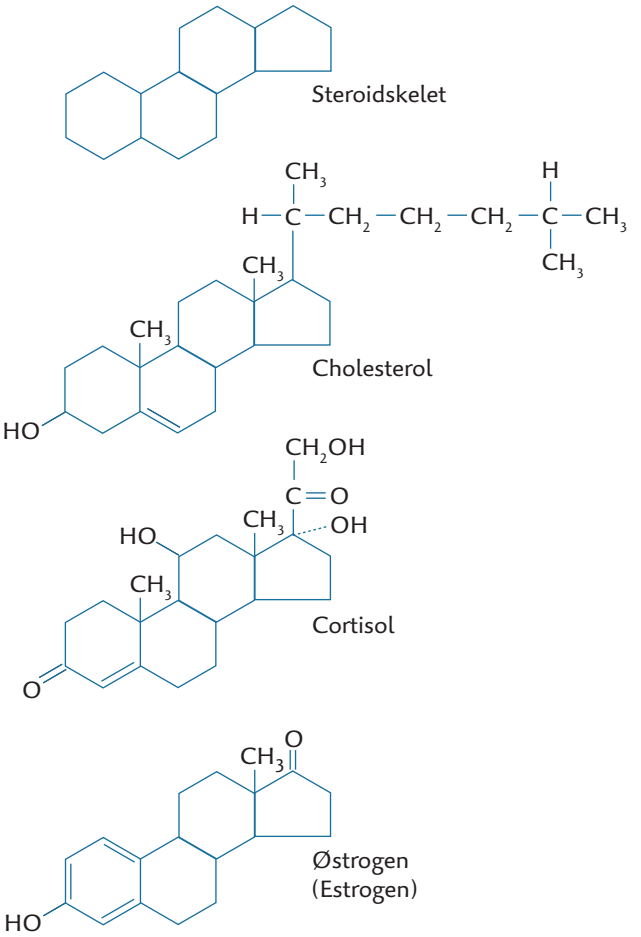


Figur 43. Steroidskelet og eksempler på stoffer der indeholder et steroidskelet.

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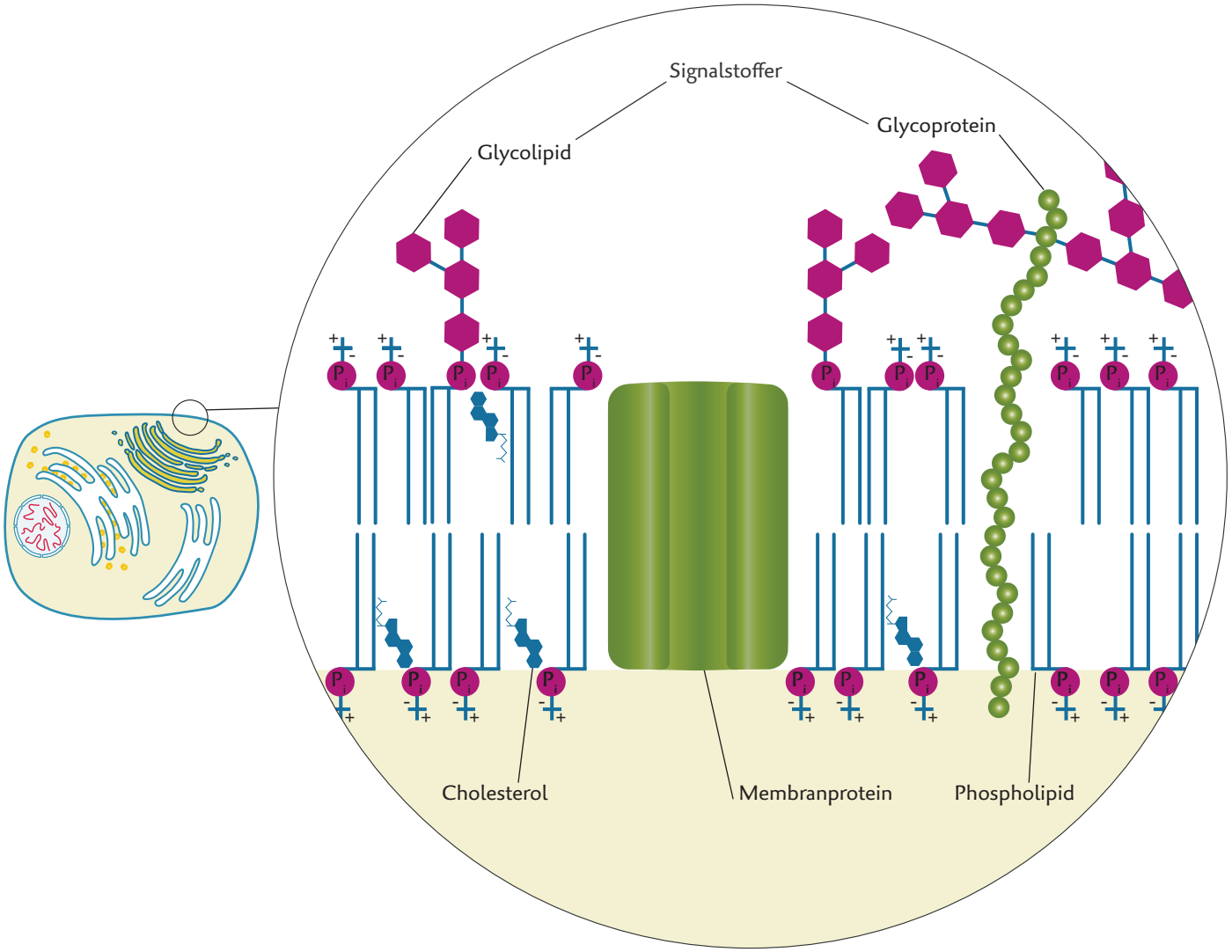


Figur 44. Cellemembranens molekyler.
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| | Ionkoncentration | |
|---|---|---|
| | Intracellulært | Ekstracellulært |
| $Na^+$ | 10 mM | 140 mM |
| $K^+$ | 140 mM | 4 mM |
| $Ca^{2+}$ | 0,0001 mM | 2 mM |

Figur 45. Koncentration af stoffer inden i og uden for cellen.
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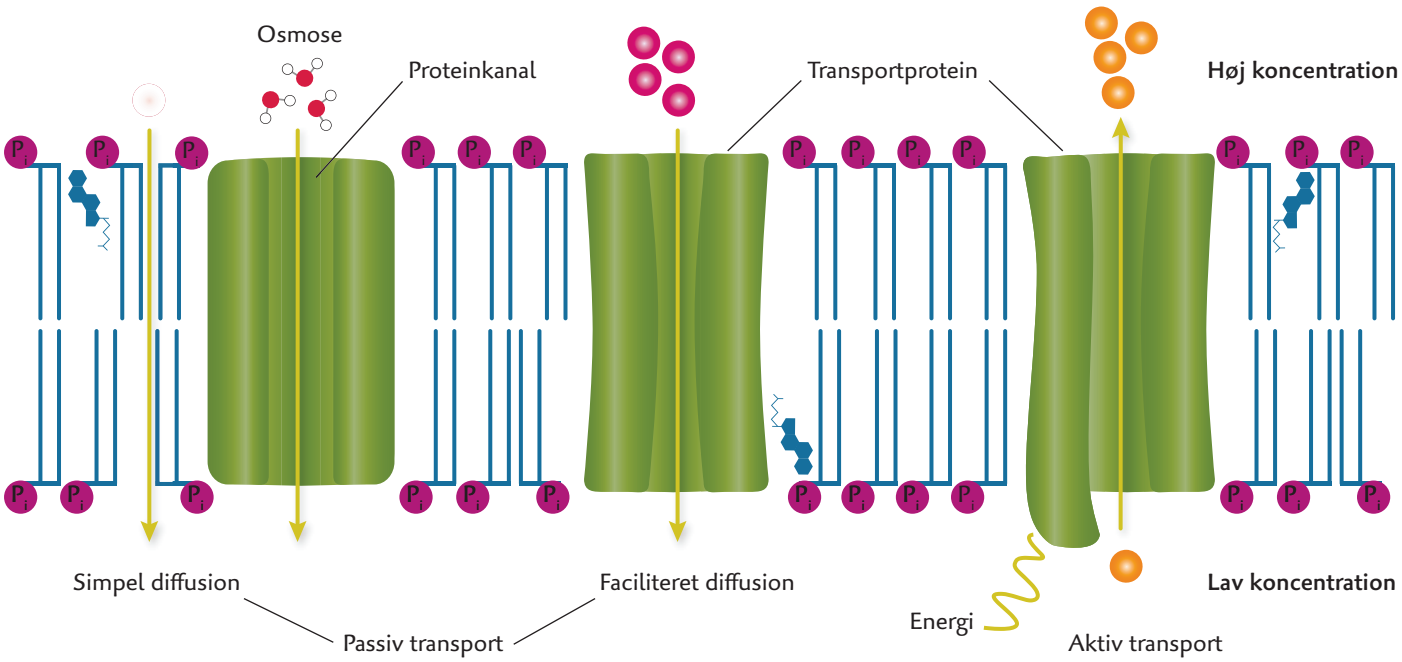


Figur 46. Membrantransportprocesser.
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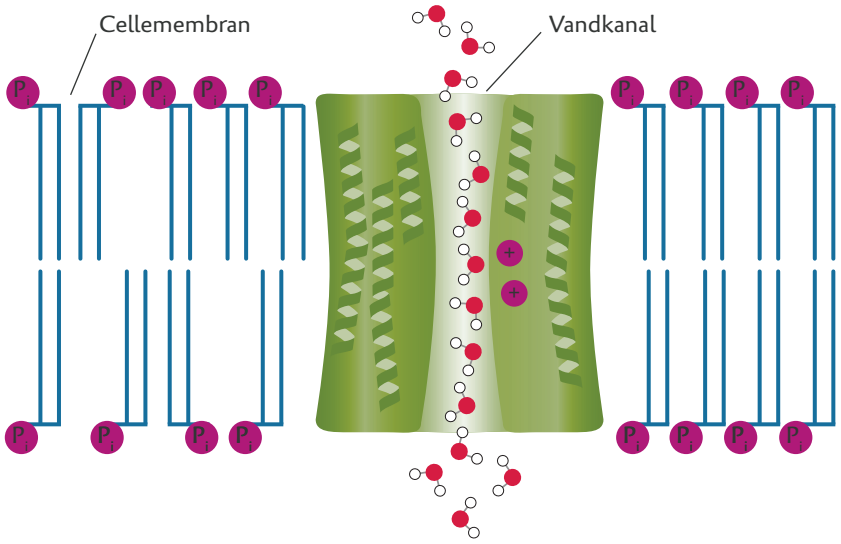


Figur 47. Vandkanal.

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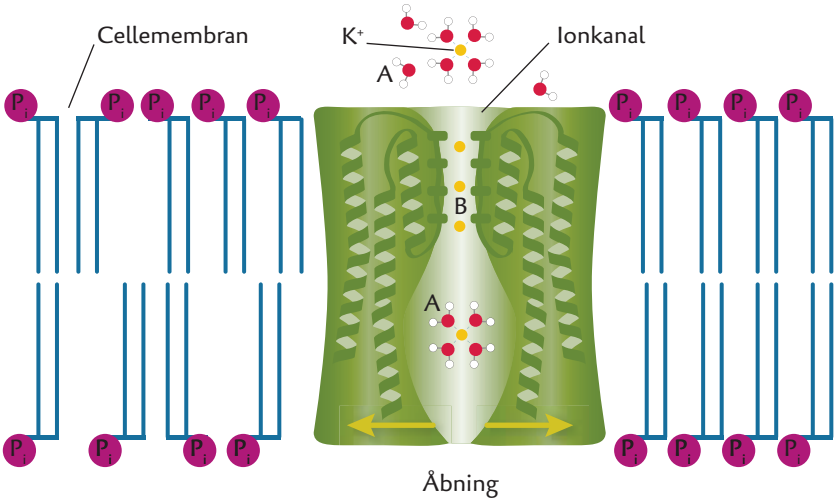


Figur 48. Kaliumkanal.
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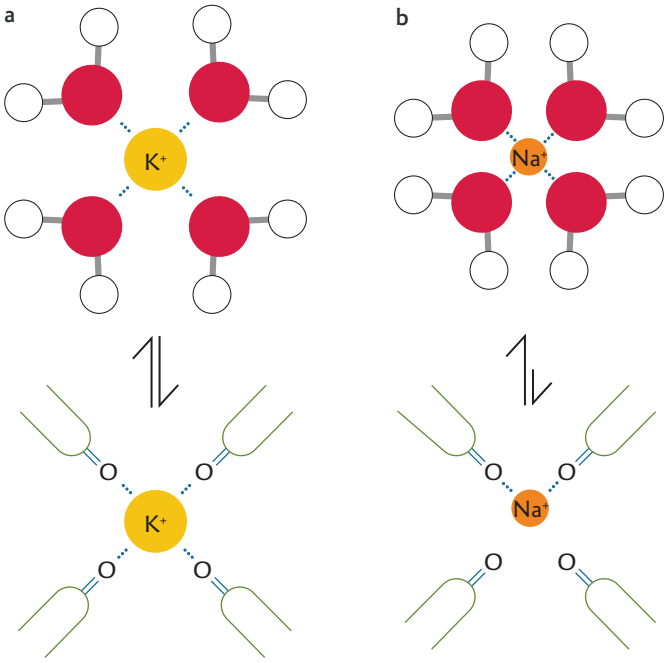


Figur 49. Kaliumioners (a) og natriumioners (b) placering i vandige omgivelser i forhold til oxygenatomerne.

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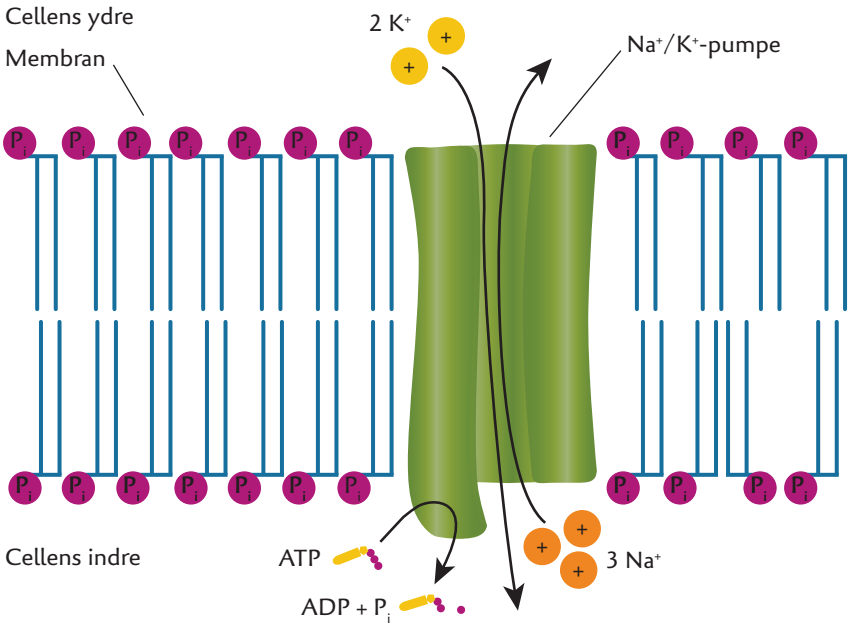


Figur 50. Na⁺/K⁺-pumpen.
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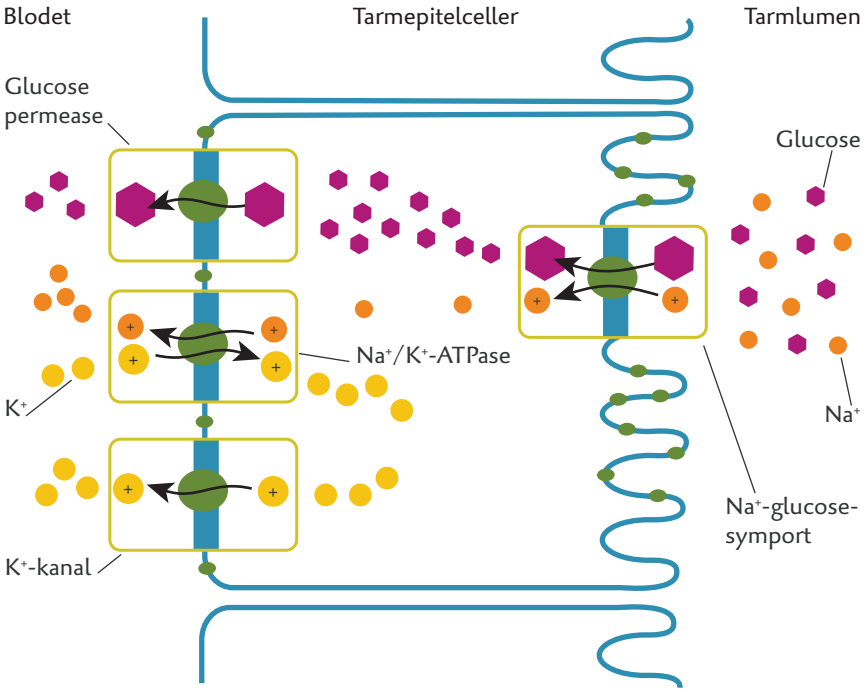


Figur 51. Eksempel på symport cotransport.
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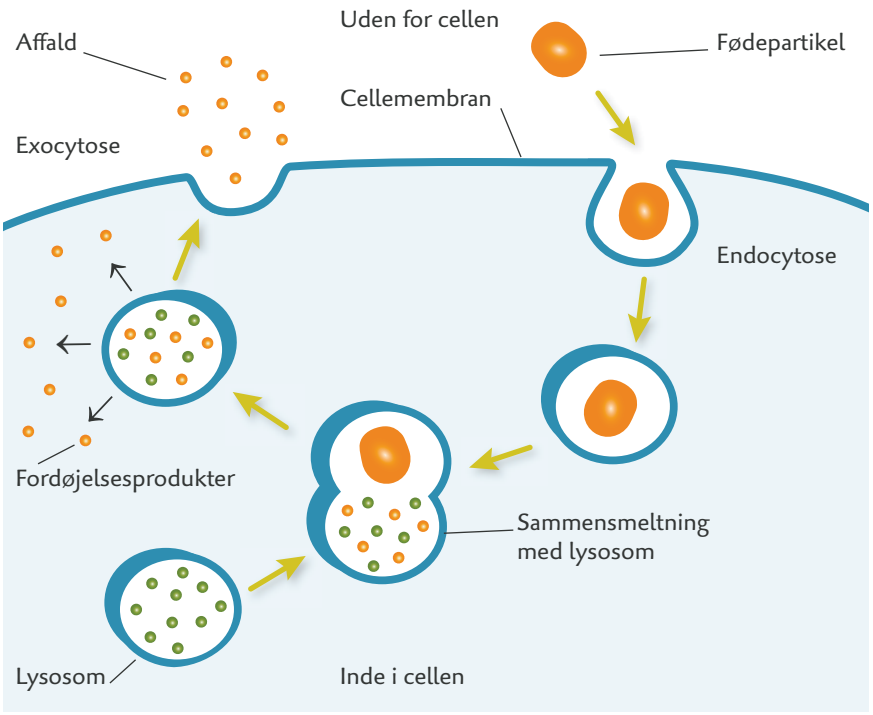


Figur 52. Endocytose og exocytose.
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**a**

| | $C_6H_{12}O_6$(aq) | 2 $C_2H_5OH$(aq) | 2 $CO_2$(g) |
|---|---|---|---|
| Masse (g) | 180,18 | | |
| Molarmasse (g/mol) | 180,18 | 46,08 | 44,01 |
| Stofmængde (mol) | 1 | 2 | 2 |

**b**

| | $C_6H_{12}O_6$(aq) | 2 $C_2H_5OH$(aq) | 2 $CO_2$(g) |
|---|---|---|---|
| Masse (g) | 180,18 | 92,16 | 88,02 |
| Molarmasse (g/mol) | 180,18 | 46,08 | 44,01 |
| Stofmængde (mol) | 1 | 2 | 2 |

Figur 53 a. Beregning af massen af ethanol og carbondioxid.
b. Et mol glucose forgæres til to mol ethanol og carbondioxid.
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