Review Summary – CH370 - Exam 2

Nucleic Acids - Microarrays

Stabilization (destabilization) Hydrogen Bonding / Electrostatics / Stacking
Denatured DNA: Heat denaturation of DNA is called "melting," Tm / *hypo*chromism.
DNA microarrays – general principles of gene-expression / roles of mRNA, cDNA
Profiling with fluorescent labels (red / green / yellow)

Radioactivity and Counting

Radioactive decay processes (α / β+ / β- / E.C.); Radioactivity rays (γ-rays)
Half life: A = Ao exp(-kt) where k = ln2/half-life
Measurement of Radioactivity: Geiger Counter / Film / PhosphorImagers / LSC
Liquid Scintillation Counting: Excited solvent / 1^o "fluor" / 2^o "fluor" / PM

Electrophoresis – transport of charged particle in an electric field.

Theory: $F_{tot} = qE - fv = ma = m(dv/dt) = 0$; $v = (qE/f)$
$f = 6\pi\eta R$ for spheres; η = Viscosity ~ 0.01g/(cm-sec)
Ferguson Plots: electrophoretic mobility reflects both charge and size/shape
Methods: slab / tube / seq. gels / (native; denatured) / Disc. Gel / PAGE / PFGE / IEF / CE
SDS-PAGE (subunit MW) / buffer system / stains; IEF gels / 2D-PAGE

Centrifugation

Theory: $F_{tot} = m_{eff}\omega^2 r - fv = m\omega^2 r(1 - \nu'\rho) - fv = ma = m(dv/dt) = 0$; ($\nu'$ is "ν bar")
Preparative Methods: RCF / Rotors / Density Gradient: Zonal vs. Isopycnic Methods
Analytical Methods / Modern Analytical Ultracentrifuge
Optics: **Schlieren** (α = aK(**dc/dx**); **Interference (**Δ**J** = (aKΔ**c**)/λ); **Abspt. optics** (A ~ **c**)
Sedimentation Velocity: $s = v/\omega^2 r = (m(1 - \nu'\rho)/f)$; → plot **(ln r) vs. t → slope = sω^2**
Sed, Vel. plus Diffusion: **$D = (kT/f) = (RT/ N^o f)$** ; → **$s = MD(1 - \nu'\rho)/RT$**
Sedimentation Equil.: **$\ln c_r - \ln c_{rm} = [M\omega^2(1 - \nu'\rho)/(2RT)](r^2 - r_m^2)$** → plot **ln c vs. r^2**

Light Scattering: "Static" vs. "Dynamic"

Wavelength >> particle size
Rayleigh (Static) Scattering – $i/I_o = N[8\pi^4\alpha^2 / r^2\lambda^4](1 + \cos^2\theta)$ for unpolarized radiation.
Raleigh Ratio: $R_\theta = (i_\theta / I_\theta)(r^2 / (1 + \cos^2\theta)) = [2\pi^2 n_o^2 (dn/dC)^2 / \lambda^4 N_o^2]\, CM$ or **$R_\theta = KCM$**
$KC/R_\theta = 1/(M*P(\theta)) + 2A_2C$; Mean Square Radius (**Rg**) 10 nm to 150 nm
Polydispersity (*Mw/Mn*); If normalized, LS = RI for monomer but LS = 2*RI for dimer
Dynamic Light Scattering –Hydrodynamic (Stokes) Radius (**R_h**) 1.5 to 1000 nm
Experimental (Use of LS and RI); **$LS = K_{LS}CM(dn/dC)^2$**: **$RI = K_{RI}C(dn/dC)$**
or **$LS/RI = M[(K_{LS}/K_{RI})(dn/dC)]$ or $M = K'(LS)/(RI)$**
Wavelength << particle size; SAXS → shape information from interference / folding, binding

CD

Terms: CD / plane polarized light vs. circularly polarized light, etc.
Special type of spectroscopy - meas. the difference in left and right handed absorbance **A(l)- A(r).**
The instrument: measurements in far **UV 180-240 nm (proteins); 180-300 nm (nucleic acids)**.
CD spectra can distinguish types of secondary structure (helix, sheet, r.coil / B-DNA, A-DNA) etc.
Applications: Folding / Secondary Structure / Denaturation / Thermal Stability / Binding