Abszorbancia

$\lambda = 410\ nm$

$\varepsilon = 25000\ \frac{1}{M cm}$

$l = 0{,}2\ cm$ küvetta

$0{,}2 \cdot 25000 = 5000\ \frac{1}{M}$

$\frac{dA}{dt} = 0{,}002\ \frac{1}{s}$

Lambert-Beer

$A = \varepsilon \cdot l \cdot c$

ε -> abszorpciós koefficiens

l -> réteg vastagság

c -> koncentráció

$A = \varepsilon \cdot l \cdot c \quad / \frac{d}{dt}$

$$\frac{d}{dt}(A) = \frac{d}{dt}(\varepsilon \cdot l \cdot c) = \varepsilon \cdot l \cdot \frac{dc}{dt}$$

$\frac{dc}{dt} = v$ -> koncentráció idő szerinti deriváltja a reakció sebesség

$$v = \frac{1}{\varepsilon \cdot l} \cdot \frac{dA}{dt} = \frac{1}{5000\ \frac{1}{M}} \cdot 0{,}002\ \frac{1}{s}$$

$$v = 4 \cdot 10^{-4}\ \frac{M}{s} = 400\ \frac{nM}{s}$$

Michaelis-Menten modell

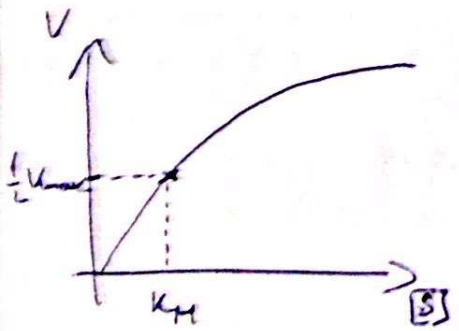
$$V_0 = \frac{V_{max}[S]}{K_m + [S]}$$

Steady State *

$$\Rightarrow \frac{d[ES]}{dt} = 0$$

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_2} E + P$$

$$K_M = \frac{k_{-1} + k_2}{k_1}$$



$K_M = [S]$

$$\rightarrow \frac{V_{max}[S]}{[S] + [S]} = \frac{1}{2} V_{max}$$

$$\frac{d[P]}{dt} = k_2[ES] \qquad \frac{d[ES]}{dt} = k_1[E] \cdot [S] - (k_2 + k_{-1})[ES] = 0 \quad *$$

Steady State -> [ES] változása nulla!

k_{cat}/K_M , deriváció

	[S]	$\frac{dA}{dt}$	V_0
1,	20 μM	0,00118 $\frac{1}{s}$	$4{,}72 \cdot 10^{-8}$
2,	40 μM	0,00223 $\frac{1}{s}$	$8{,}92 \cdot 10^{-8}$
3,	60 μM	0,00335 $\frac{1}{s}$	$3{,}34 \cdot 10^{-7}$

$$V_0 = \frac{V_{max} \cdot [S]}{K_M + [S]} \quad (=)$$

$s \ll K_M$ *

$$(=) \quad \frac{V_{max}\,[S]}{K_M}$$

$$V_0 = \frac{[S] \cdot k_{cat} \cdot [E]_T}{K_M} = \underbrace{\frac{k_{cat}}{K_M}}_{\text{analitikus hatékonyság}} \cdot [E]_T \cdot [S] \qquad \overset{*}{V_{max}} = k_2 [E]_T \;, \; k_2 = k_{cat}$$

$$V_0 = \frac{dA/dt}{\varepsilon \cdot l} = \frac{1}{\varepsilon} \cdot \frac{dA}{dt} \qquad \varepsilon = 25000 \cdot \frac{1}{M\,cm}$$

1 μg/ml MW - 25 kDa -> enzim

$$c_M = \frac{c_T}{M} = \frac{1\,\mu g/ml}{25\,kDa} = \frac{0{,}001\,g/l}{25000\,g/mol} = 4 \cdot 10^{-8}\,mol/l = [E]_T$$

$$\frac{k_{cat}}{K_M} = \frac{V_0}{[E]_T\,[S]} \Rightarrow$$

1, 59000

2, 55450

3, 55833

$\bar{x} = 56861$

$\sigma = \sqrt{\frac{1}{2}(2139^2 + \ldots + \ldots)} = 185$

st. deviáció : $5{,}69 \pm 0{,}19 \cdot 10^4$

BPG + ADP ⇌ PG + ATP

$R = 8{,}31\ J/molK$

① ATP → $\Delta G^\circ = -30{,}5$ kJ/mol

② BPG → $\Delta G^\circ = -49$ kJ/mol

① $ATP + H_2O \rightleftharpoons ADP + P_i \quad -30{,}5$

② $BPG + H_2O \rightleftharpoons PG + P_i \quad -49$

$ADP + P_i \rightleftharpoons ATP + H_2O \quad 30{,}5$ } *

* $BPG + ADP \rightleftharpoons PG + ATP \rightarrow -18{,}5\ \frac{kJ}{mol}$

0,1	0,1	0	0
x	x	0,1−x	0,1−x

$$\Delta G = \Delta G^\circ + R \cdot T \cdot \ln \frac{[PG][ATP]}{[ADP][BPG]}$$

$\Delta G^\circ = -RT \cdot \ln K$ → egyensúly esetén

$$-18500\ \frac{J}{mol} = -8{,}31\ \frac{J}{molK} \cdot 310K \cdot \ln \frac{[\ ][\ ]}{[\ ][\ ]}$$

$$K = \frac{(0{,}1-x^2)}{x^2} = \frac{0{,}1^2 - 0{,}2x + x^2}{x^2}$$

$$K = e^{-\frac{\Delta G^\circ}{RT}} = e^{-\frac{18500}{-8{,}31 \cdot 310}} = 1315$$

$$1315 = \frac{(0{,}1-x^2)}{x^2}$$

$$36{,}26 = \frac{0{,}1-x}{x}$$

$$x = \frac{0{,}1}{37{,}26} = 0{,}00268$$

kiindulás: $c = 2{,}68 \cdot 10^{-3}\ M$

termék: $c = 0{,}09734\ M$

Membrán pot.

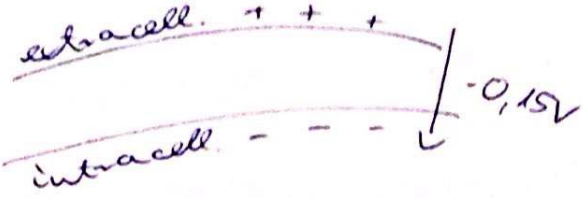
$F = 96\,485$ C/mol

$\Delta U = -0{,}15$ V

$R = 8{,}314$ J/molK

ATP hidr. $\rightarrow \Delta G = -47$ kJ/mol

$\frac{[H^+_{ext}]}{[H^+_{in}]} = 26$



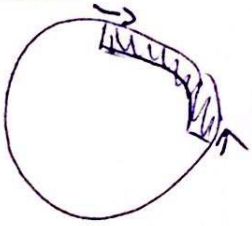
$$\Delta G = R \cdot T \cdot \ln \frac{[H^+_e]}{[H^+_i]} + Z \cdot F \cdot \Delta U$$

$\Delta G = 22{,}87 \frac{kJ}{mol}$ 70% ~ $16{,}01 \frac{kJ}{mol}$

ATP hidr. $\rightarrow -47 \frac{kJ}{mol}$

$\frac{47 \text{ kJ/mol}}{16{,}01 \text{ kJ/mol}} = 2{,}93 \approx 3p^+$

Plazmid



plazmid $\rightarrow$ 5000 bp

célgén $\rightarrow$ 1000 bp

$80_{rg} = 80 \cdot 10^{-12}$ g plazmid

$\frac{80}{5} \cdot 10^{-12}$ g célgén $= 16 \cdot 10^{-12}$ g $\rightarrow$ 1 µg kell!

$= x 10^{-6}$ g

$16 \cdot 10^{-12}$ g $\cdot x = 10^{-6}$ g

$x = \frac{10^{-6}}{16 \cdot 10^{-12}} = 62\,500 \Rightarrow$ ennyi sejtese kell

Tudjuk, h 1 PCR ciklusban duplázódik

$62500 = 2^x$

$x = \log_2 62500 = 15{,}93 \sim 16$ ciklus

PCR beadás

① 26

② 33 $\Delta n = 7 \Rightarrow 2^7 = 128$

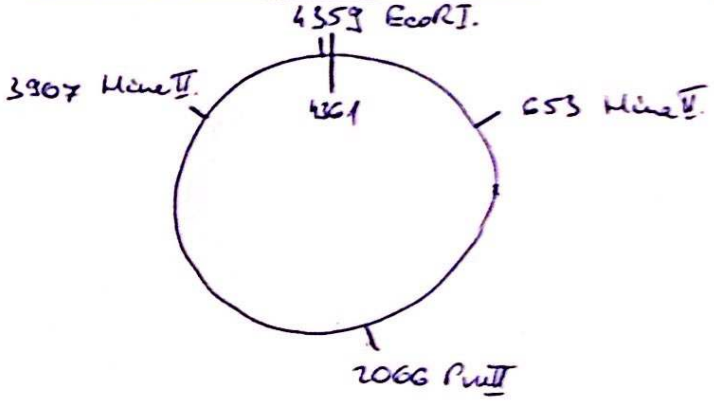
$\Rightarrow$ 128 szor több } 100 %-os hatékonyság

94 %-nál $100 + 94 \Rightarrow 1,94$

$1,94^7 = 103,42$ szeres

Restrikciós enzimek

4361 bp ar egész



① PvuII. + EcoRI.

4359 - 2066 = 2293 bp

4361 - 2293 = 2068 bp

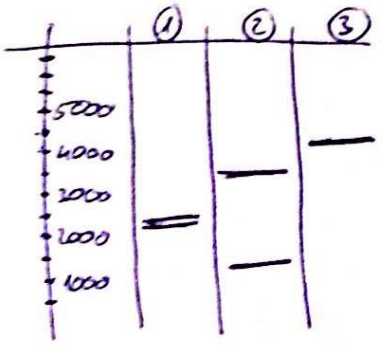
② 3907 - 653 = 3254 bp

4361 - 3254 = 1107 bp

HincII.

③ EcoRI.

4361 - 0



Membrándiffúzió

$s = (4 \cdot D \cdot t)^{1/2}$

$D = 1 \mu m^2/s$

$d = 3 \mu m \Rightarrow r = 1,5 \mu m$

$s = \frac{3}{2}\pi \cdot \frac{1}{2} \cdot 2 = \frac{3}{2}\pi$

$K = 2\pi r$

$\frac{3}{2}\pi = \sqrt{1 \cdot t \cdot 4}$

$\frac{3}{2}\pi = 2\sqrt{t}$

$t = \frac{9}{16}\pi^2 s$