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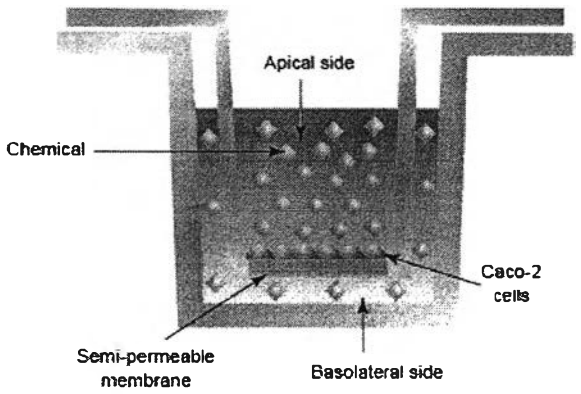
APPENDICES

APPENDIX I

Transwell® inserts (Albert, 2001)

Transwell® inserts for transport studies (Albert, 2001)



Semipermeable membrane	=	polycarbonate membrane (pore size = 3 μM)
Area of semipermeable membrane	=	4.71 cm^2 (6-well plate)
	=	1 cm^2 (12-well plate)
	=	0.33 cm^2 (24-well plate)
Apical volume	=	1.5 cm^3 (6-well plate)
	=	0.5 cm^3 (12-well plate)
	=	0.1 cm^3 (24-well plate)
Basolateral volume	=	2.6 cm^3 (6-well plate)
	=	1.5 cm^3 (12-well plate)
	=	0.6 cm^3 (24-well plate)

Average TEER ± S.D. of the polycarbonate membranes (experimentally determined) = 106.61 ± 3.78 $\Omega \cdot cm^2$ (6-well plate)

APPENDIX II

Components of apical and basolateral buffers for transport study (Mainprize and Grady, 1998)

Apical buffer

Hank's balanced salt solution	935 ml
1 M D-Glucose monohydrate	25 ml
1 M MES Biological buffer	20 ml
125 mM Calcium chloride	10 ml
50 mM Magnesium chloride	10 ml

Adjusted with potassium hydroxide to a pH of 6.5

Basolateral buffer

Hank's balanced salt solution	935 ml
1 M D-Glucose monohydrate	25 ml
1 M HEPES Biological buffer	20 ml
125 mM Calcium chloride	10 ml
50 mM Magnesium chloride	10 ml

Adjusted with potassium hydroxide to a pH of 7.4

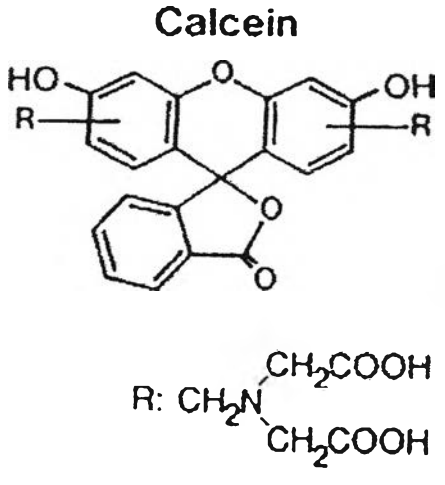
APPENDIX III

Molecular structures of calcein, rhodamine 123, and verapamil hydrochloride (Sigma-Aldrich, 2004; Straubinger et al., 1983)

Calcein (Sigma-Aldrich, 2004; Straubinger et al., 1983)

Empirical: $C_{30}H_{26}N_2O_{13}$

Structure: bis(N,N'–di(carboxymethyl)-aminomethyl)



(From Straubinger et al., 1983)

Molecular weight: 622.5

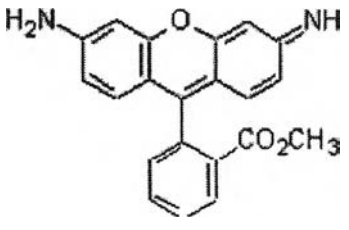
Solubility: clear orange to brown solution at 50 mg/ml in 1 M sodium hydroxide

Storage temperature: store at room temperature

Rhodamine 123 (Sigma-Aldrich, 2004)

Empirical: $C_{21}H_{17}ClN_2O_3$

Structure: 2-(6-Amino-3-imino-3H-xanthen-9-yl)benzoic acid methyl ester



HCl

(From Sigma-Aldrich, 2004)

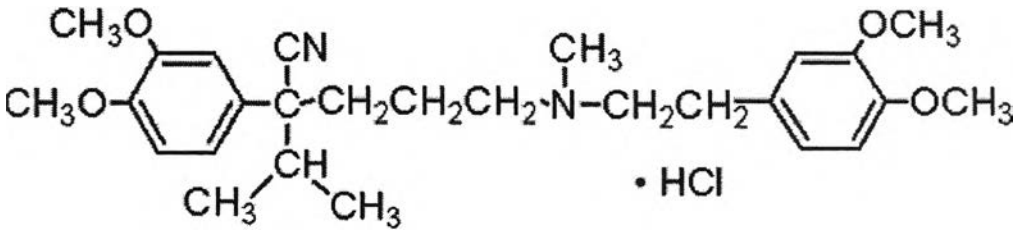
Molecular weight: 380.83

Solubility: soluble in 100% ethanol and water

Storage temperature: store at room temperature

± **Verapamil hydrochloride** (Sigma-Aldrich, 2004)

Empirical: $(CH_3O)_2C_6H_3CH_2CH_2N(CH_3)(CH_2)_3C[C_6H_3(OCH_3)_2][CH(CH_3)_2]CN \cdot HCl$
Structure: 5-[N-(3,4-Dimethoxyphenylethyl)methylamino]-2-(3,4-dimethoxyphenyl)-2-isopropylvaleronitrile hydrochloride



(From Sigma-Aldrich, 2004)

Molecular weight: 491.06
Solubility: methanol: 50 mg/ml, clear, colorless
Storage temperature: store at room temperature

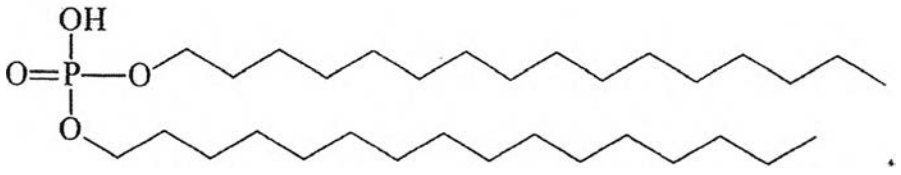
APPENDIX IV

Molecular structures of PC, DCP, SA and CH
(Sigma-Aldrich, 2004; Graham and Higglin, 1997; New, 1997)

Dicetylphosphate (DCP, dihexadecyl phosphate) (Sigma-Aldrich, 2004)

Empirical: $C_{32}H_{67}O_4P$

Structure: $(CH_3(CH_2)_{15}O)_2P(O)OH$



Molecular weight: 546.9

Melting point: 74-75 °C

Stearylamine (SA, octadecylamine) (Sigma-Aldrich, 2004)

Empirical: $C_{18}H_{39}N$

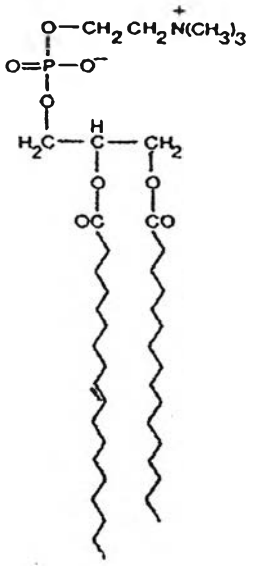
Structure: 1-aminooctadecane

$$CH_3(CH_2)_{16}CH_2NH_2$$

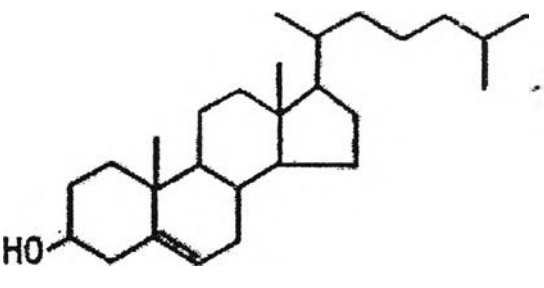
Molecular weight: 269.5

Melting point: 55-57 °C

Molecular structure of phosphatidylcholine (From Graham and Higglin, 1997)



Molecular structure of cholesterol (From New, 1997)



Cholesterol

APPENDIX IV

Standard curves of phenol red, theophylline, calcein, and rhodamine 123 and results of statistical analysis

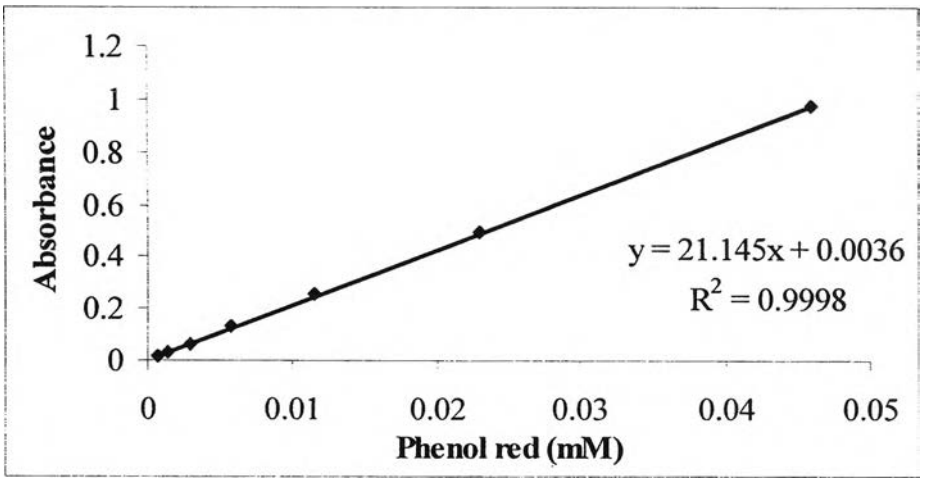


Figure 27: A representation of calibration curve of phenol red in basolateral buffer

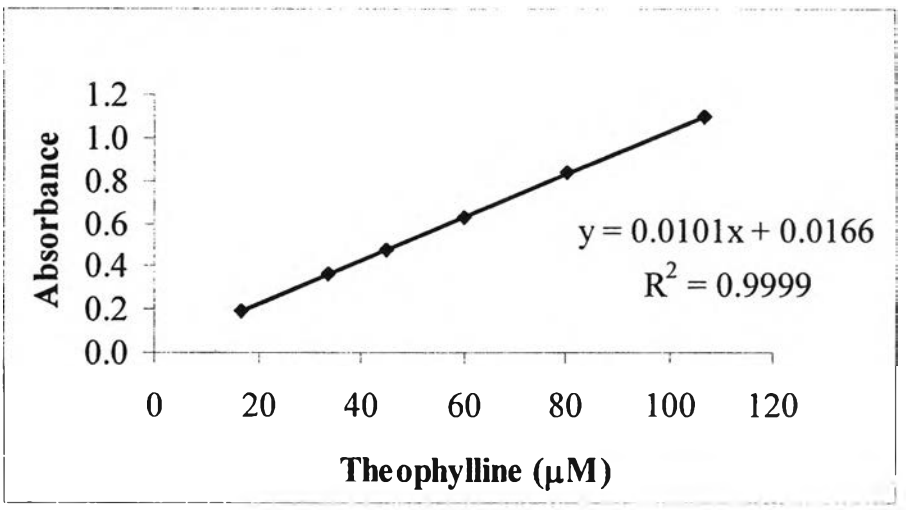


Figure 28: A representation of calibration curve of theophylline in apical buffer

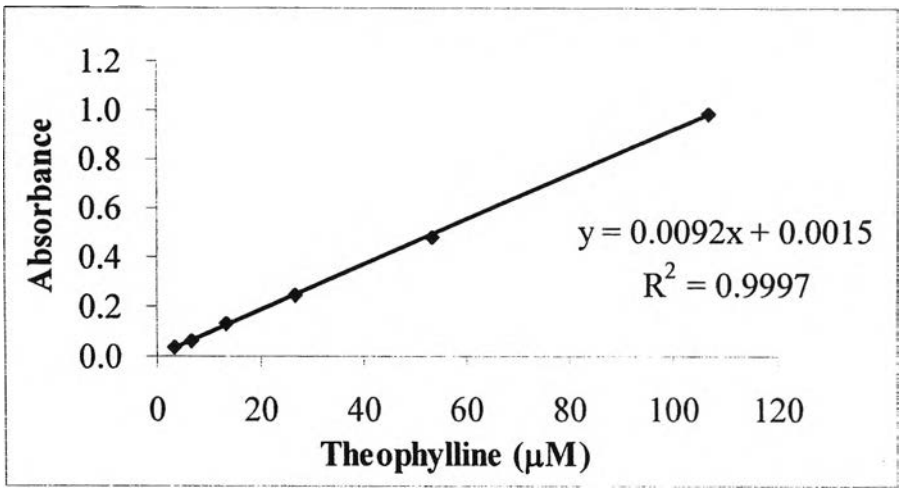


Figure 29: A representation of calibration curve of theophylline in basolateral buffer

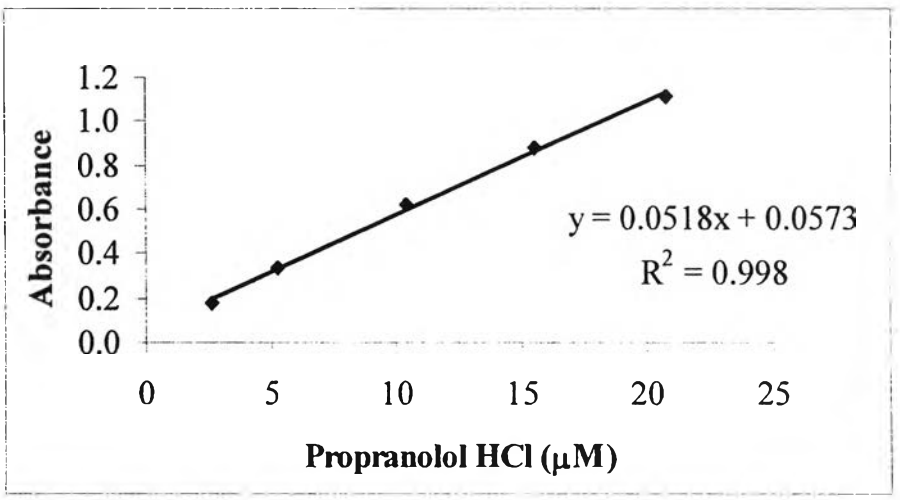


Figure 30: A representation of calibration curve of propranolol in apical buffer

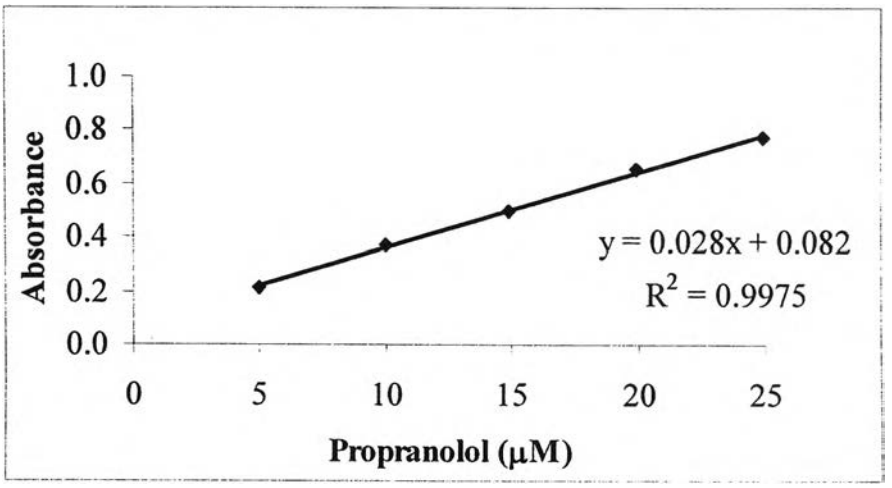


Figure 31: A representation of calibration curve of propranolol in basolateral buffer

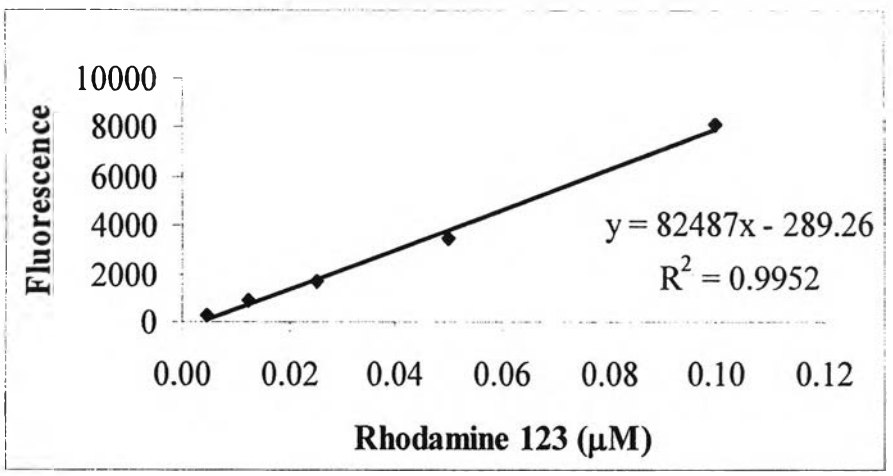


Figure 32: A representation of calibration curve of rhodamine 123 in apical buffer

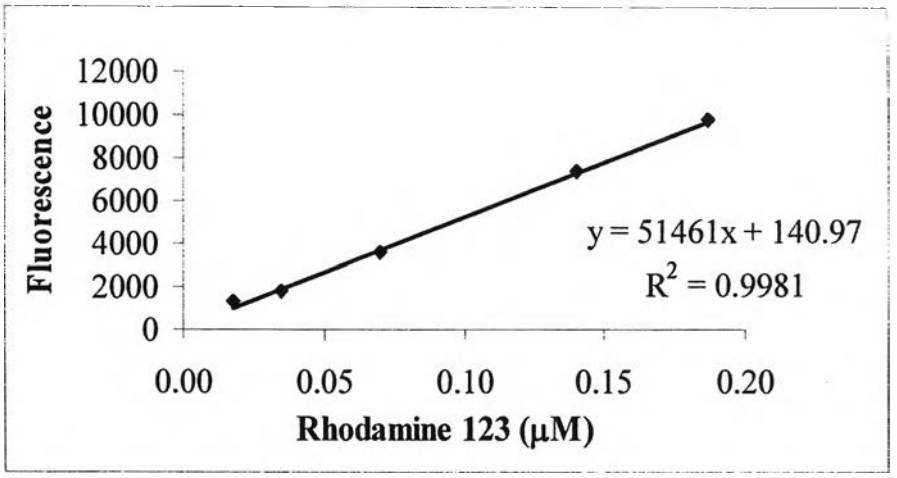


Figure 33: A representation of calibration curve of rhodamine 123 in basolateral buffer

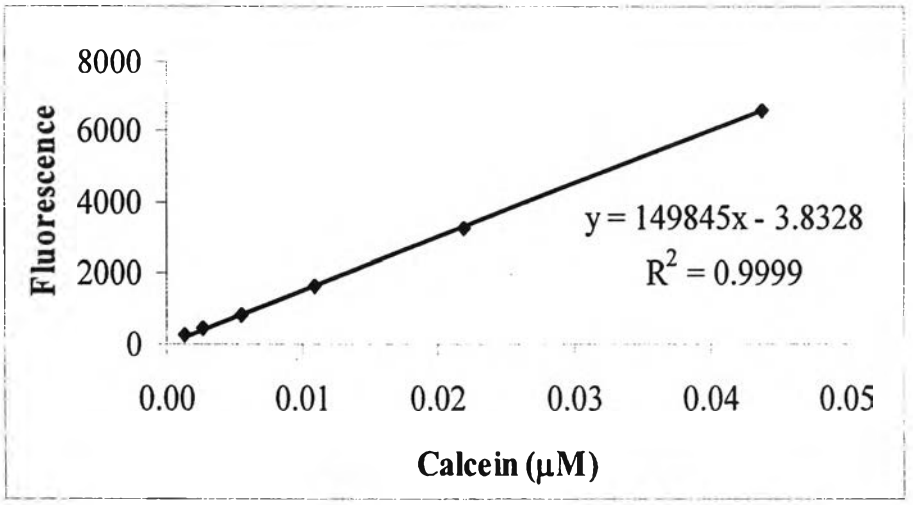


Figure 34: A representation of calibration curve of calcein in 1% Tritron X-100

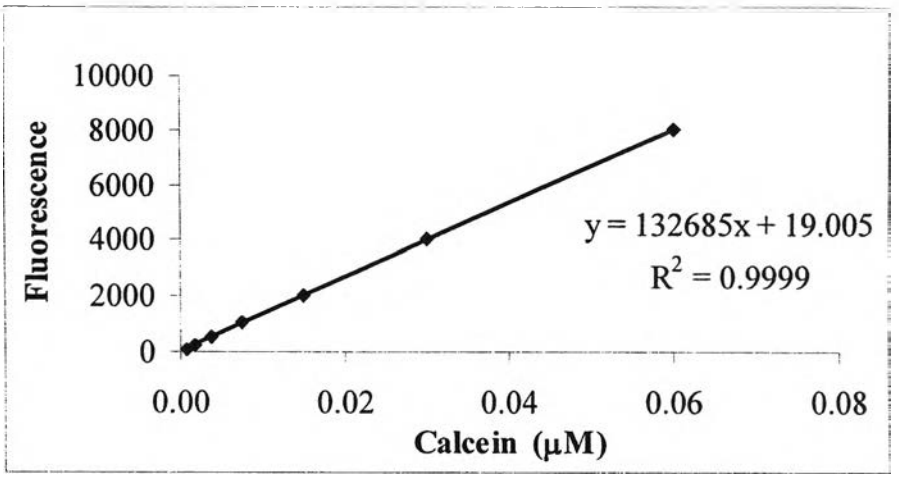


Figure 35: A representation of calibration curve of calcein in basolateral buffer

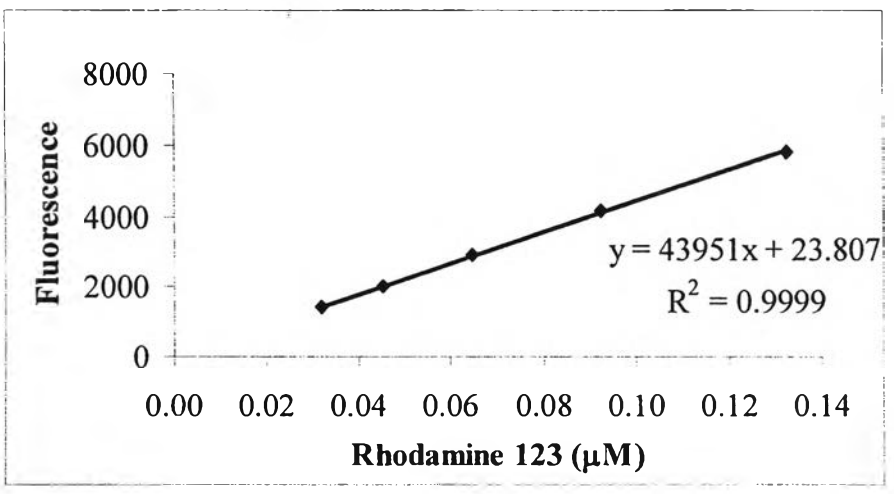


Figure 36: A representation of calibration curve of rhodamine 123 in 1% Tritron X-100

Table 17: Statistical analysis of theophylline permeability across Caco-2 monolayers

Paired Samples Statistics

	Transport direction	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	A-to-B	3.2367	3	0.24685	0.14252
	B-to-A	5.5800	3	0.74940	0.43267

Paired Samples Correlations

	Transport direction	N	Correlation	Sig.
Pair 1	A-to-B & B-to-A	3	0.538	0.638

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
	Transport direction	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	A-to-B – B-to-A	-2.3433	0.65064	0.37565	-3.9596	-0.7271	-6.238	2	0.025

Table 18: Statistical analysis of propranolol permeability across Caco-2 monolayers

Paired Samples Statistics

Transport direction		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	A-to-B	3.2100	3	0.13454	0.07767
	B-to-A	7.0467	3	0.92959	0.53670

Paired Samples Correlations

Transport direction		N	Correlation	Sig.
Pair 1	A-to-B & B-to-A	3	0.716	0.492

Paired Samples Test

Transport direction		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	A-to-B – B-to-A	-3.8367	0.83859	0.48416	-5.9198	-1.7535	-7.924	2	0.016

Table 19: Statistical analysis of rhodamine 123 permeability with/without verapamil across Caco-2 monolayers

Paired Samples Statistics

Transport direction		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	A-to-B	0.42500	3	0.085000	0.049075
	B-to-A	2.81333	3	0.282902	0.163333
Pair 2	A-to-B with verapamil	0.90333	3	0.132138	0.076290
	B-to-A with verapamil	0.72800	3	0.077904	0.044978
Pair 3	A-to-B	0.42500	3	0.085000	0.049075
	A-to-B with verapamil	0.90333	3	0.132138	0.076290
Pair 4	B-to-A	2.81333	3	0.282902	0.163333
	B-to-A with verapamil	0.72800	3	0.077904	0.044978

Paired Samples Correlations

	Transport direction	N	Correlation	Sig.
Pair 1	A-to-B & B-to-A	3	-0.972	0.151
Pair 2	A-to-B with verapamil & B-to-A with verapamil	3	-0.962	0.176
Pair 3	A-to-B & A-to-B with verapamil	3	0.836	0.369
Pair 4	B-to-A & B-to-A with verapamil	3	.0459	0.696

Table 19 (continued): Statistical analysis of rhodamine 123 permeability with/without verapamil across Caco-2 monolayers

Paired Samples Test

	Transport direction	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	A-to-B & B-to-A	-2.38833	0.366071	0.211351	-3.29771	-1.47896	-11.300	2	.008
Pair 2	A-to-B with verapamil & B-to-A with verapamil	0.17533	0.208169	0.120186	-0.34179	0.69245	1.459	2	.282
Pair 3	A-to-B & A-to-B with verapamil	-0.47833	0.076814	0.044348	-0.66915	-0.28752	-10.786	2	.008
Pair 4	B-to-A & B-to-A with verapamil	2.08533	0.256656	0.148180	1.44776	2.72290	14.073	2	.005

Table 20: Statistical analysis of interaction of time after seeding and calcein concentration on accumulation of calcein solution in Caco-2 cells

Descriptive Statistics

Dependent Variable: Uptake solution

Concentration (μM)	Days	Mean	Std. Deviation	N
50	3	1.0233	0.42194	3
	5	2.4500	0.99413	3
	7	3.2200	0.14000	3
	Total	2.2311	1.10824	9
75	3	1.9767	0.40723	3
	5	2.4967	0.99972	3
	7	3.3000	0.51682	3
	Total	2.5911	0.83154	9
100	3	1.9300	0.39154	3
	5	2.2233	1.72236	3
	7	3.6667	0.96293	3
	Total	2.6067	1.28838	9
Total	3	1.6433	0.58389	9
	5	2.3900	1.12009	9
	7	3.3956	0.58824	9
	Total	2.4763	1.06427	27

Table 20 (continued): Statistical analysis of interaction of time after seeding and calcein concentration on accumulation of calcein solution in Caco-2 cells

Levene's Test of Equality of Error Variances(a)

Dependent Variable: Uptake solution

F	df1	df2	Sig.
3.664	8	18	0.011

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Design: Intercept+CONC+DAYS+CONC * DAYS

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	16.118(a)	8	2.015	2.721	0.037
Intercept	165.565	1	165.565	223.557	0.000
CONC	0.813	2	0.406	0.549	0.587
DAYS	13.917	2	6.958	9.396	0.002
CONC * DAYS	1.389	4	0.347	0.469	0.758
Error	13.331	18	0.741		
Total	195.014	27			
Corrected Total	29.449	26			

a R Squared = .547 (Adjusted R Squared = .346)

Table 21: Statistical analysis of interaction of time after seeding and calcein concentration on accumulation of calcein-loaded liposomes in Caco-2 cells

Descriptive Statistics

Dependent Variable: Uptake liposome

Concentration (μM)	Days	Mean	Std. Deviation	N
50	3	8.2700	1.25790	3
	5	7.7200	1.86952	3
	7	9.5400	0.40286	3
	Total	8.5100	1.40121	9
75	3	9.7700	1.57788	3
	5	9.6233	1.86270	3
	7	11.5667	0.60277	3
	Total	10.3200	1.56810	9
100	3	9.1167	2.36606	3
	5	9.3533	0.14154	3
	7	12.9333	2.05020	3
	Total	10.4678	2.42597	9
Total	3	9.0522	1.68575	9
	5	8.8989	1.59424	9
	7	11.3467	1.83534	9
	Total	9.7659	1.99859	27

Table 21 (continued): Statistical analysis of interaction of time after seeding and calcein concentration on accumulation of calcein-loaded liposomes in Caco-2 cells

Levene's Test of Equality of Error Variances(a)

Dependent Variable: Uptake liposome			
F	df1	df2	Sig.
2.541	8	18	.048

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a Design: Intercept+CONC+DAYS+CONC * DAYS

Tests of Between-Subjects Effects

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	61.086(a)	8	7.636	3.214	0.019
Intercept	2575.079	1	2575.079	1083.789	0.000
Concentration	21.392	2	10.696	4.502	0.026
Days	33.839	2	16.919	7.121	0.005
Concentration * Days	5.854	4	1.464	0.616	0.657
Error	42.768	18	2.376		
Total	2678.933	27			
Corrected Total	103.854	26			

a R Squared = .588 (Adjusted R Squared = .405)

Table 22: Statistical analysis of concentration dependence of calcein uptake by Caco-2 cells

Paired Samples Statistics

	Concentration	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Liposome 20μM	4.4567	3	0.50738	0.29294
	Solution 20μM	0.22000	3	0.097709	0.056412
Pair 2	Liposome 40μM	7.0767	3	1.02256	0.59038
	Solution 40μM	0.49933	3	0.058654	0.033864
Pair 3	Liposome 60μM	8.2500	3	1.42717	0.82397
	Solution 60μM	0.60600	3	0.211348	0.122022
Pair 4	Liposome 80μM	10.3200	3	2.14119	1.23622
	Solution 80μM	1.34367	3	0.553715	0.319688
Pair 5	Liposome 100μM	11.0667	3	1.10151	0.63596
	Solution 100μM	1.8633	3	0.50461	0.29134
Pair 6	Liposome 120μM	10.8333	3	3.82143	2.20630
	Solution 120μM	2.0100	3	0.58796	0.33946
Pair 7	Liposome 140μM	10.7867	3	2.28266	1.31789
	Solution 140μM	2.4433	3	0.54151	0.31264

Paired Samples Correlations

	Calcein uptake	N	Correlation	Sig.
Pair 1	Liposome 20 μM & Solution 20μM	3	-0.273	0.824
Pair 2	Liposome 40 μM & Solution 40μM	3	0.824	0.384
Pair 3	Liposome 60 μM & Solution 60μM	3	0.701	0.506
Pair 4	Liposome 80 μM & Solution 80μM	3	0.809	0.400
Pair 5	Liposome 100 μM & Solution 100μM	3	-0.796	0.414
Pair 6	Liposome 120 μM & Solution 120μM	3	0.738	0.471
Pair 7	Liposome 140 μM & Solution 140μM	3	-0.430	0.717

Table 22 (continued): Statistical analysis of concentration dependence of calcein uptake by Caco-2 cells

Paired Samples Test

	Calcein uptake	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Liposome 20 µM & Solution 20µM	4.23667	0.542301	0.313098	2.88952	5.58382	13.531	2	0.005
Pair 2	Liposome 40 µM & Solution 40µM	6.57733	0.974808	0.562806	4.15578	8.99889	11.687	2	0.007
Pair 3	Liposome 60 µM & Solution 60µM	7.64400	1.287924	0.743583	4.44462	10.84338	10.280	2	0.009
Pair 4	Liposome 80 µM & Solution 80µM	8.97633	1.724056	0.995384	4.69354	13.25913	9.018	2	0.012
Pair 5	Liposome 100 µM & Solution 100µM	9.2033	1.53383	0.88556	5.3931	13.0136	10.393	2	0.009
Pair 6	Liposome 120 µM & Solution 120µM	8.8233	3.41058	1.96910	0.3510	17.2957	4.481	2	0.046
Pair 7	Liposome 140 µM & Solution 140µM	8.3433	2.56235	1.47937	1.9781	14.7086	5.640	2	0.030

Table 23: Statistical analysis of effect of temperature on calcein uptake

Paired Samples Statistics

	Calcein uptake	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Liposome 37 °C	5.35333	3	0.192180	0.110955
	Solution 37 °C	0.50000	3	0.091329	0.052729
Pair 2	Liposome 4 °C	2.33000	3	0.253574	0.146401
	Solution 4 °C	0.51500	3	0.021932	0.012662
Pair 3	Liposome 37 °C	5.35333	3	0.192180	0.110955
	Liposome 4 °C	2.33000	3	0.253574	0.146401
Pair 4	Solution 37 °C	0.50000	3	0.091329	0.052729
	Solution 4 °C	0.51500	3	0.021932	0.012662

Paired Samples Correlations

	Calcein uptake	N	Correlation	Sig.
Pair 1	Liposome 37 °C & Solution 37 °C	3	-0.058	0.963
Pair 2	Liposome 4 °C & Solution 4 °C	3	-0.060	0.962
Pair 3	Liposome 37 °C & Liposome 4 °C	3	0.012	0.992
Pair 4	Solution 37 °C & Solution 4 °C	3	0.105	0.933

Table 23 (continued): Statistical analysis of effect of temperature on calcein uptake

Paired Samples Test

	Calcein uptake	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Liposome 37 °C & Solution 37 °C	4.85333	0.217473	0.125558	4.31310	5.39357	38.654	2	0.001
Pair 2	Liposome 4 °C & Solution 4 °C	1.81500	0.255834	0.147706	1.17947	2.45053	12.288	2	0.007
Pair 3	Liposome 37 °C & Liposome 4 °C	3.02333	0.316280	0.182605	2.23765	3.80902	16.557	2	0.004
Pair 4	Solution 37 °C & Solution 4 °C	-0.01500	0.091652	0.052915	-0.24267	0.21267	-0.283	2	0.803

Table 24: Statistical analysis of effect of liposomal composition on calcein uptake by Caco-2 cells

Descriptives

Formulations	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
PC/CH	4	10.48250	0.560260	0.280130	9.59100	11.37400	9.730	11.000
PC/SA/CH	4	10.71250	1.008477	0.504238	9.10779	12.31721	9.860	11.900
PC/DCP/CH	4	4.74500	0.200749	0.100374	4.42556	5.06444	4.540	4.990
SOLUTION	4	1.34575	0.857087	0.428544	-0.01807	2.70957	0.820	2.620
Total	16	6.82144	4.144646	1.036162	4.61291	9.02996	0.820	11.900

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
3.740	3	12	.042

ANOVA

Test	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	251.354	3	83.785	159.149	0.000
Within Groups	6.317	12	0.526		
Total	257.671	15			

Table 24 (continued): Statistical analysis of effect of liposomal composition on calcein uptake by Caco-2 cells

Multiple Comparisons

Dependent Variable: formulations
Dunnett T3

Formulations		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
PC/CH	PC/SA/CH	-0.23000	0.576827	0.998	-2.55915	2.09915
	PC/DCP/CH	5.73750(*)	0.297570	0.000	4.39258	7.08242
	SOLUTION	9.13675(*)	0.511979	0.000	7.15309	11.12041
PC/SA/CH	PC/CH	0.23000	0.576827	0.998	-2.09915	2.55915
	PC/DCP/CH	5.96750(*)	0.514132	0.004	3.41766	8.51734
	SOLUTION	9.36675(*)	0.661745	0.000	6.92004	11.81346
PC/DCP/CH	PC/CH	-5.73750(*)	0.297570	0.000	-7.08242	-4.39258
	PC/SA/CH	-5.96750(*)	0.514132	0.004	-8.51734	-3.41766
	SOLUTION	3.39925(*)	0.440142	0.012	1.25619	5.54231
SOLUTION	PC/CH	-9.13675(*)	0.511979	0.000	-11.12041	-7.15309
	PC/SA/CH	-9.36675(*)	0.661745	0.000	-11.81346	-6.92004
	PC/DCP/CH	-3.39925(*)	0.440142	0.012	-5.54231	-1.25619

* The mean difference is significant at the .05 level.

Table 25: Statistical analysis of effect of liposomes on transport of calcein across Caco-2 monolayers

Paired Samples Statistics

	Transport	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Solution	7.66667	3	2.134861	1.232563
	Liposome	1.17933	3	0.540963	0.312325

Paired Samples Correlations

	Transport	N	Correlation	Sig.
Pair 1	Solution & Liposome	3	-0.415	0.728

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
	Transport	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Solution & Liposome	6.48733	2.409971	1.391398	0.50063	12.47403	4.662	2	0.043

Table 26: Statistical analysis of effect of liposomes on accumulation of calcein in Caco-2 cells (after transport study)

Paired Samples Statistics

Accumulation		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Solution	140.6433	3	6.42151	3.70746
	Liposome	237.5667	3	29.31364	16.92424

Paired Samples Correlations

Accumulation		N	Correlation	Sig.
Pair 1	Solution & Liposome	3	-0.960	0.181

Paired Samples Test

Accumulation		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Solution & Liposome	-96.9233	35.52369	20.50961	-185.1691	-8.6776	-4.726	2	0.042

Table 27: Statistical analysis of effect of liposomes and phospholipids with/without verapamil on accumulation of rhodamine 123 in Caco-2 cells

Paired Samples Statistics

	Formulations	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Solution	1.3100	3	0.08544	0.04933
	Liposome	4.1433	3	0.09292	0.05364
Pair 2	Solution	1.3100	3	0.08544	0.04933
	Blank liposome + Solution	1.1800	3	0.07937	0.04583
Pair 3	Blank liposome + Solution	1.1800	3	0.07937	0.04583
	Incubated blank liposome + Solution	1.2467	3	0.05033	.02906
Pair 4	Solution	1.3100	3	0.08544	0.04933
	Solution with verapamil	3.1033	3	0.35572	0.20537
Pair 5	Liposome	4.1433	3	0.09292	0.05364
	Liposome with verapamil	5.9267	3	0.16862	0.09735
Pair 6	Blank liposome +Solution	1.1800	3	0.07937	0.04583
	Blank liposome + Solution with verapamil	1.4267	3	0.06110	0.03528

Table 27 (continued): Statistical analysis of effect of liposomes and phospholipids with/without verapamil on accumulation of rhodamine 123 in Caco-2 cells

Paired Samples Correlations

	Formulations	N	Correlation	Sig.
Pair 1	Solution & Liposome	3	-0.743	0.467
Pair 2	Solution & Blank liposome +Solution	3	0.686	0.519
Pair 3	Blank liposome +Solution & Incubated blank liposome +Solution	3	-0.976	0.139
Pair 4	Solution & Solution with verapamil	3	0.997	0.050
Pair 5	Liposome& Liposome with verapamil	3	0.974	0.144
Pair 6	Blank liposome +Solution & blank liposome +Solution with verapamil	3	0.000	1.000

Paired Samples Test

	Formulations	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Solution & Liposome	-2.8333	0.16653	0.09615	-3.2470	-2.4196	-29.468	2	0.001
Pair 2	Solution & Blank liposome +Solution	0.1300	0.06557	0.03786	-0.0329	0.2929	3.434	2	0.075
Pair 3	Blank liposome +Solution & Incubated blank liposome +Solution	-0.0667	0.12897	0.07446	-0.3870	0.2537	-0.895	2	0.465
Pair 4	Solution & Solution with verapamil	-1.7933	0.27062	0.15624	-2.4656	-1.1211	-11.478	2	0.008
Pair 5	Liposome& Liposome with verapamil	-1.7833	0.08083	0.04667	-1.9841	-1.5825	-38.214	2	0.001
Pair 6	Blank liposome +Solution & blank liposome +Solution with verapamil	-0.2467	0.10017	0.05783	-0.4955	0.0022	-4.265	2	0.051

Table 28: Statistical analysis of effect of liposomal composition on rhodamine 123 uptake by Caco-2 cells

Descriptives

Formulations	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Solution	3	17.8667	1.53080	0.88380	14.0640	21.6694	16.70	19.60
PC/CH	3	38.3000	3.29090	1.90000	30.1250	46.4750	35.70	42.00
PC/SA/CH	3	0.8567	0.53143	0.30682	-0.4635	2.1768	0.46	1.46
PC/SA/CH	3	9.6467	1.00600	0.58081	7.1476	12.1457	8.95	10.80
Total	12	16.6675	14.56948	4.20585	7.4105	25.9245	0.46	42.00

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
4.398	3	8	.042

ANOVA

Interactions	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2306.033	3	768.678	212.521	0.000
Within Groups	28.936	8	3.617		
Total	2334.968	11			

Table 28 (continued): Statistical analysis of effect of liposomal composition on rhodamine 123 uptake by Caco-2 cells

Multiple Comparisons

Dependent Variable: formulation
Dunnett T3

Formulations		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Solution	PC/CH	-20.4333(*)	2.09550	0.011	-31.9079	-8.9587
	PC/SA/CH	17.0100(*)	0.93555	0.004	11.2751	22.7449
	PC/SA/CH	8.2200(*)	1.05757	0.011	3.1937	13.2463
PC/CH	Solution	20.4333(*)	2.09550	0.011	8.9587	31.9079
	PC/SA/CH	37.4433(*)	1.92461	0.006	23.5531	51.3335
	PC/SA/CH	28.6533(*)	1.98679	0.008	15.9706	41.3360
PC/SA/CH	Solution	-17.0100(*)	0.93555	0.004	-22.7449	-11.2751
	PC/CH	-37.4433(*)	1.92461	0.006	-51.3335	-23.5531
	PC/SA/CH	-8.7900(*)	0.65687	0.003	-12.1981	-5.3819
PC/SA/CH	Solution	-8.2200(*)	1.05757	0.011	-13.2463	-3.1937
	PC/CH	-28.6533(*)	1.98679	0.008	-41.3360	-15.9706
	PC/SA/CH	8.7900(*)	0.65687	0.003	5.3819	12.1981

* The mean difference is significant at the .05 level.

Table 29: Statistical analysis of effect of liposomes on transport of rhodamine 123 across Caco-2 monolayers

Paired Samples Statistics

	Transport	Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Solution	7.0533	3	0.67248	0.38826
	Liposome	9.6133	3	0.33486	0.19333

Paired Samples Correlations

	Transport	N	Correlation	Sig.
Pair 1	Solution & Liposome	3	-0.906	0.279

Paired Samples Test

	Transport	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Solution & Liposome	-2.5600	0.98605	0.56930	-5.0095	-0.1105	-4.497	2	0.046

VITA

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