Tatung University map

PBL participants and group members

Group	Member 1	Member 2	Member 3	Member 4	Member 5	Member 6
1	許哲寧 Andy	何慕柔 Michelle	陳冠旗 Tachanka	浦野 碧 Urano, Aoi	福田彩加 Fukuta, Ayaka	谷口敦暉 Taniguchi, Atsuki
2	林俊穎 Rupert	謝卓玲 Hazel	中村芽依 Nakamura, Mei	植田菜摘 Ueda, Natsumi	大谷悠人 Otani, Yto	
3	詹惠晴 Haru	陳世軒 Sean	林 愛里 Hayashi, Airi	樋口恵実 Higuchi, Megumi	山本雄大 Yamamoto, Yuta	
4	趙晨鈞 Jason	劉繼元 Rebecca	林中悦 Echo	前野美久 Maeno, Miku	山下絵理香 Yamashita, Erika	横井春奈 Yokoi, Haruna
5	李湘慈 Tina	陳劭銘 Solomin	黎寧頁 Nelson	熊谷朱莉 Kumagai, Shuri	山下侑子 Yamashita, Yuko	横田 諒 Yokota, Ryo

Wifi (Connect to “ttuweb” or “ttuwifi”)

User Name	Account	Password	User Name	Account	Password
藤里俊哉	coe001	coe001	山本雄大	coe010	coe010
宇戸禎仁	coe002	coe002	福田彩加	coe011	coe011
前野美久	coe003	coe003	山下侑子	coe012	coe012
大谷悠人	coe004	coe004	樋口恵実	coe013	coe013
林 愛里	coe005	coe005	熊谷朱莉	coe014	coe014
横田 諒	coe006	coe006	浦野碧	coe015	coe015
谷口敦暉	coe007	coe007	植田菜摘	coe016	coe016
山下絵理香	coe008	coe008	中村芽依	coe017	coe017
横井春奈	coe009	coe009			

PBL program coordinators:

Professor Hu, Yi (胡毅) (TTU)

Professor Fujisato, Toshiya (藤里俊哉) (OIT)

PBL group leaders:

Professor Wang, Chung-Yih (王鐘毅)

PBL program secretary: Huang, Fong-Yi (黃丰怡) and Cheng, Hsiao-Ping(鄭筱蘋)

PBL program assistant: Andy (許哲寧) and Haru (詹惠晴)

2019 Tatung University-Osaka Institute of Technology International Project-Based Learning Program Book

September 2~September 7, 2019

Day 1 (Sep. 2, Monday)

15:10	Flight CI 157 arrival at Taoyuan Airport
16:00~17:00	Take bus to Tatung University
17:00~17:50	Check in Tatung Scholar House
18:15	Meet at the lobby of Tatung Scholar House
18:30	Welcome dinner (in 海霸王)

Day 2 (Sep. 3, Tuesday)

09:30~10:00	Welcoming remarks (in A2-505)
10:00~10:30	Campus tour
10:30~12:00	PBL demo and experiments
12:00~13:00	Lunch
13:00~16:00	PBL demo and experiments
16:00~	Take MRT to 龍山寺/剝皮寮/西門町/饒河夜市

Day 3 (Sep. 4, Wednesday)

09:00 Free activity

- Route A Visit Tamsui: Fort San Domingo (紅毛城),TamSui Customs Officer's Residence (淡水關稅務司官邸(小白宮), TamSui old street (淡水老街), Fisherman's wharf (漁人碼頭)
- Route B 貓空
- Route C 十分/十三層遺址/金瓜石

15:00~16:30 All member to Jiufen (九份)

16:30~18:00 Visit Jiufen

18:00 Dinner

Day 4 (Sep. 5, Thursday)

8:20~ Meet at Main gate of Tatung University

8:30~11:15 Take bus to Fourways Cheese Factory (竹南四方牧場)

11:15~12:45 Lunch at 清水 rest area (stay 1 hr)

12:45~14:30 National Taichung Theater 台中歌劇院 (designed by 伊東豐雄, stay 1 hr)

14:30 宮原眼科 Miyahara /The original store of Chun Shui Tang 春水堂創始店/ Yizhong street 一中商圈 (stay 1.5 hr)

16:30 Gaomei wetland 高美濕地/Wind farm 風力發電(stay 1 hr)

Day 5 (Sep. 6, Friday)

9:00-10:30	Preparation and Wrap-up presentation(at 新德惠 606 class)
11:00	Visit Yongkang Street (永康街), CKS memorial hall 中正紀念堂, Taipei 101, or National palace museum 故宮博物院
18:00	Visit Shilin Night Market (士林夜市)

Day 6 (Sep. 07, Saturday)

10:00~	Check out
10:50~12:00	Take bus to Taoyuan Airport
12:00~12:30	Flight Check in
14:20~18:50	Flight CI172 and Arrival at Kansai Airport

PBL1~5 demo and experiments

PBL1: Beer workshop

Instructor: Professor Duan, Kow-Jen (段國仁)/Place:A3-804

Introduction

Craft beer, or hand-made beer, is a traditional beer made by monk in an abbey. Nowadays, we define craft beer as a beer that was produced by a microbrewery. Such breweries are generally characterized by their emphasis on quality, flavor and brewing technique.

You can be a brewmaster if you are training in a workshop to learn the basic techniques of mashing, pitching, fermentation and bottling condition.

修道院の醸造風景

The beer workshop starts from introduction of ingredients of beer, malts, yeast, hops, water. You may take 3~4 hour to practice mash the wort. We will use a pot and induction cooker to make wort from malts. Of course, to make fine quality wort is the basis to make a good beer. In the wort mashing practice, I will talk about skills to make good quality wort. In addition to wort practice, you will practice yeast pitching, beer fermentation and bottling for secondary fermentation. Each student can take 3 bottles of beer made by yourself to home.

Barley malts: Malted barley contains all necessary nutrients for yeast. The malted barley contains the necessary enzymes to hydrolyze starch and protein to fermentable sugars, amino acid, soluble proteins, and polysaccharides that will retain in the beer.

Yeasts: Yeast eats sugar to make alcohol is the basis of beer fermentation. Saccharomyces cerevisiae is usually used in beer fermentation. A yeast beer is characterized by its sugar digest and flocculation abilities, and flavors to produce.

Hops: Hops gives characteristic bitterness and flavors of beer. In the early years, hops were used for bacteriostatic purpose. Hop is added to wort at boiling for one hour. During hop boiling, alpha-acids are isomerized to more bitter iso-alpha-acid. Ten min before ending of wort boiling, aroma hop is added to the boiling wort, and then the wort is cooled to the pitching temperature around 10~25^{o}C.

PBL2: Preparation of high moisture mask and lotion with surfactants

Instructor: Professor Wang, Chung-Yih (王鐘毅)/Place:A3-702

Introduction

The stratum corneum (SC) is constantly changing and adapting as people aged. It is now believed that barrier function-correlates directly with age the SC is drier in the elderly persons. Reduced SC hydration in the elderly persons would imply that aged skin is less attractive to hydrophilic molecules and to water. Water supplement can be achieved with many skin moisturizing product, such as mask, serum and lotion.

You will learn the effective ingredients that help to retain water in SC. To prepare lotion and serum, you need to understand the role of surfactants and learn how to mix hydrophilic contents and hydrophobic contents with different types of surfactants.

<u>High moisture and smoothing mask</u>

Material of paper:

- Rayon
- Cotton
- Biocellulose

Procedure to prepare the serum of the mask：

1. Weigh Xanthan Gum and dissolve in water to prepare 0.5% solution (gel like).
2. Weigh Hyaluronic acid and dissolve in water to prepare 0.5 % solution (gel like).
3. Weigh the other contents and mix water accordingly. The total weight is 100 g or total volume is 100 mL.
4. Fold the mask paper and insert into the bag.
5. Pour 25 mL of serum into the bag and sealed

Table1. Ingredients of serum for mask

INCI NAME	中文名稱	Percentage (mL)
Aqua	純水	76.2
Glycerin	甘油	3.0
Butylene glycol	丁二醇	5.0
Aloe Barbadensis Leaf Extract	蘆薈萃取液	2.0
Chamomilla Recutita Flower Extract	野生洋甘菊萃取液	1.0
Xanthan Gum (0.5%solution)	三仙膠	10
Phenoxyethanol, Ethylhexylglycerin	複合型抗菌劑	0.25
Chlorphenesin	防腐劑	0.20
Hyaluronic acid (0.5 % solution)	玻尿酸(0.5%)	2

Moisture lotion

1. Weigh contents of group A and dissolve in water.
2. Weight contents of group B and add to group A. Mix well.
3. Weigh contents of group C and add to group (A+B). Heat the mixture if necessary.
4. Cool down to below 40^{o}C and add item D. Agitate well and transfer to clean bottle.

Table 2. Ingredients of moisture lotion.

	INCI NAME	名稱	投放量
A	Hyaluronic acid (0.5%)	玻尿酸(0.5%)	10 mL
	Glycerol	甘油 (丙三醇)	2 mL
	Aqua	純水	74 mL
B	Surfactants	簡易乳化劑	2 mL
C	Vitamin E	維他命 E	1 mL
	Olive oil	橄欖油	10 mL
D	Phenoxyethanol	苯氧乙醇	1 mL
	Perfume	香精	2 drops

PBL3: Synthesis of magnetic nanoparticles

Instructor: Professors Yu, Chi-Yang (游吉陽) and Kuan, I-Ching (官宜靜) /Place:A3-810

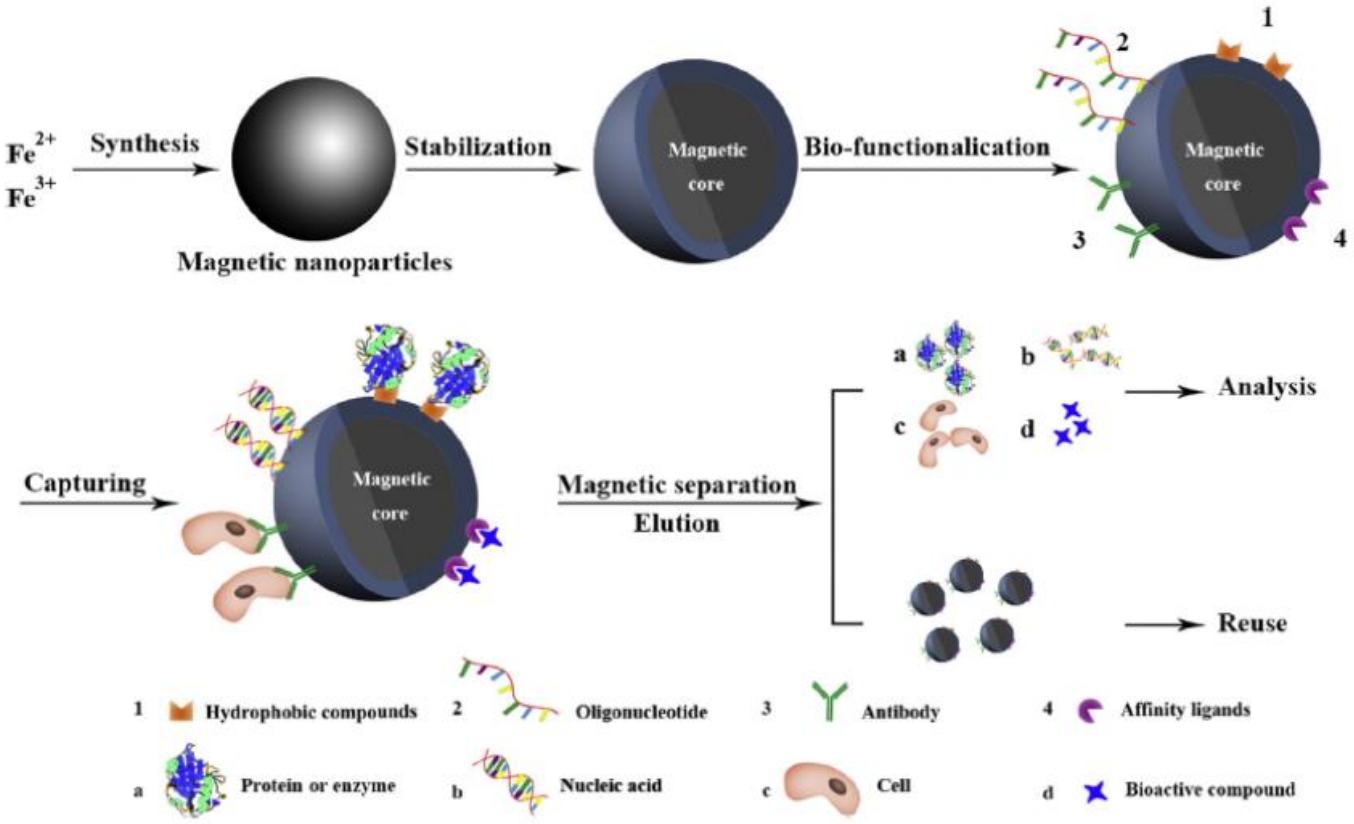
Introduction

Magnetic nanoparticles are of great interest for researchers from a wide range of disciplines, including magnetic fluids, catalysis, biotechnology/biomedicine, and environmental remediation. In most of these applications, the particles perform best when the size of the nanoparticles is below a critical value, which is dependent on the material but is typically around 10–20 nm.

Magnetic nanoparticles have been synthesized with a number of different compositions and phases, including iron oxides, such as Fe_3O_4 and γ-Fe_2O_3, pure metals, such as Fe and Co, spinel-type ferromagnets, such as $MgFe_2O_4$, $MnFe_2O_4$, and $CoFe_2O_4$, as well as alloys, such as $CoPt_3$ and FePt. Several popular methods including co-precipitation, thermal decomposition and/or reduction, micelle synthesis, hydrothermal synthesis, and laser pyrolysis techniques can all be directed at the synthesis of high-quality magnetic nanoparticles. In this experiment, we will prepare the Fe_3O_4 magnetic nanoparticles using the method of co-precipitation.

Procedure

1. Dissolve 0.4 g of $FeCl_2 \cdot 4H_2O$ and 1.08 g of $FeCl_3 \cdot 6H_2O$ in 20 ml deionized water (final $[Fe^{2+}]$ and $[Fe^{3+}]$ were 0.1 and 0.2 M, respectively)
2. Use a peristaltic pump at flow rate of 1 ml/min to add 15 ml of 29% (or 17.4 ml of 25%) NH_4OH solution under vigorous stirring at room temperature.
3. Heat the precipitates (Fe_3O_4 magnetic particles) at 80^oC for 30 min.
4. Wash Fe_3O_4 magnetic particles with 40 ml of deionized water followed by 40 ml of ethanol three times.
5. Resuspend Fe_3O_4 magnetic particles in 40 ml of ethanol and stored at 4^oC.
6. To estimate the amount of Fe_3O_4 magnetic particles produced, 1 ml of the suspension in step 5 was withdrawn and added to a 1.5 ml microcentrifuge tube. Repeat this step two times to obtain samples in triplicate. The ethanol supernatant was then removed after the Fe_3O_4 magnetic particles were separated with a magnet.
7. Place three microcentrifuge tubes in an oven at 50^oC overnight to evaporate residual ethanol. The weight of dried Fe_3O_4 magnetic particles was subsequently determined with a microbalance.

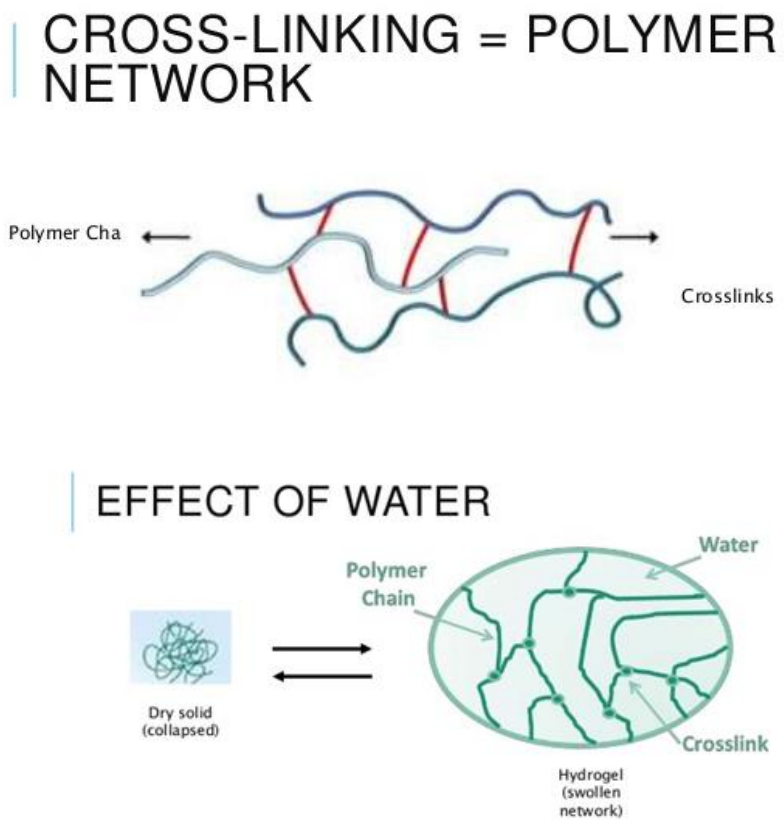

Fe2+
Fe3+
Synthesis
Magnetic nanoparticles
Stabilization
Magnetic core
Bio-functionalication
1
2
3
4
Capturing
Magnetic separation
Elution
Analysis
Reuse
1 Hydrophobic compounds
2 Oligonucleotide
3 Antibody
4 Affinity ligands
a Protein or enzyme
b Nucleic acid
c Cell
d Bioactive compound

PBL4: Synthesis and Applications of Hydrogel Materials

Instructor: Professor Lee, Wen-Fu (李文福)/Place:A2-305

Introduction

The term 'hydrogel' first appeared in the literature was in 1894. It is defined as a hydrophilic three-dimensional network of polymer chains which can swell but not dissolve in aqueous solution.



Hydrogels are highly absorbent material due to their hydrophilic structure. It can absorb plenty of water (up to one thousand times their dry weight) and hold water inside the structure. This property along with biocompatibility of hydrogel results in numerously applications in contact lenses, tissue engineering, and many biomedical fields. Other common

applications of hydrogels include:

Pharmaceutical Agriculture

Sanitary pads Trans-dermal systems

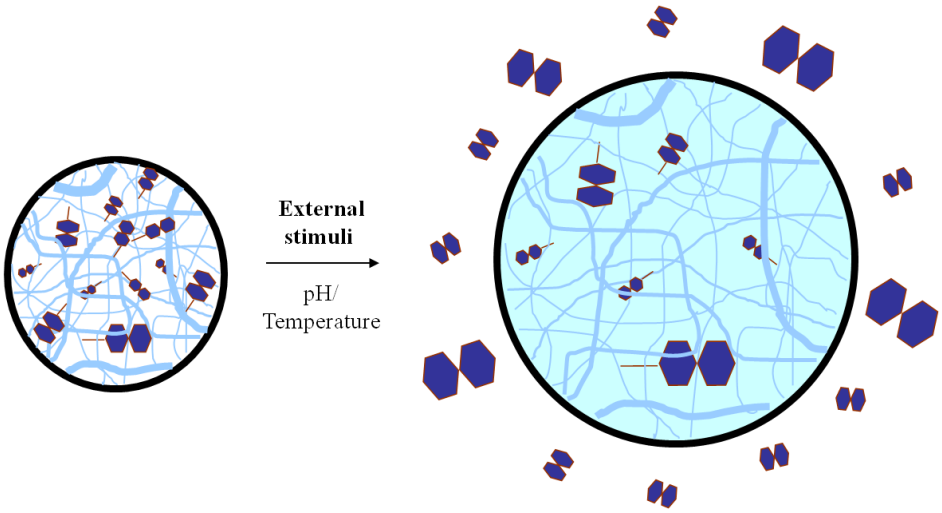
Dental materials Drug delivery

Implants Injectable polymeric systems

Ophthalmic applications

Wound dressings

Hydrogels can be designed to be stimuli sensitive and respond to surrounding environment. These hydrogels can perform dramatic volume transition in response to a variety of environmental stimuli like temperature, electric or magnetic field, light, pressure, sound, pH, solvent composition, ionic strength, and molecular species. And these stimuli-response properties can be applied on the drug releasing system and biosensor.



Preparation of hydrogel

NIPAAm, NMBA, and APS are added into the sample bottle with the amounts according to the Table 1. Water is added into the bottle until the total volume of solution is 20 mL. After that, the bottle is placed into ice bath and add 1 drop of TEMED. The solution is then injected into the mold that is immersed in hot water bath to perform polymerization. After the reaction is finished, the hydrogel is cut into disks and washed by distilled water/methanol. Finally, the gel disks are dried at room temperature, 40^{o}C and 75^{o}C, respectively.

Table 1 Feed compositions of different hydrogels

Gel code		NIPAAm (g)	NMBA (g)	APS (g)
G1	Designed	2.712	0.111	0.026
	Actual			

Demonstration of hydrogel features

- Swelling behavior
- Temperature response
- pH response
- Drug absorption

Measurement of Swelling Ratio

Weight of dried gels (W_d) are measured at first. And the gels are immersed in distilled water at 25°C. The gels are removed from the water bath and measured the weight of wet gel (W_w) at various time intervals. The swelling ratio (SR) was calculated by the following equation:

$$SR = \frac{W_w - W_d}{W_d}$$

Table 2 Weights of different gels at different times

Time (min)	G1 (g)
0	
10	
20	
30	
40	
50	
60	

Swelling behavior observation

Two dry gel disks are placed in air and 25^{o}C deionized water, respectively. After for 10 minutes, weighting and observing the hydrogel.

Temperature response observation

Two hydrogels swollen in deionized water at 25^{o}C are placed in 25^{o}C and 37^{o}C deionized water, respectively. After 10 minutes, the hydrogels are weighed and observed the difference.

Drug Release Experiment

The drug (crystal violet/ phenol red) release experiments are carried out by transferring previously incubated-drug hydrogels into 10 mL deionized water at 37^{o}C and 25^{o}C, respectively. The hydrogels are repeatedly removed and transferred into 10 mL deionized water at each fixed time interval. The drug released amounts will be observed via the difference of color.

PBL5: inorganic nanoparticle for gene delivery

Instructor: Professor Wu, Hsi-Chin (吳錫芩)/Place: A7-210

Description

The calcium phosphate transfection method for introducing gene into mammalian cells is based on forming a calcium phosphate-nucleic acids (e.g. DNA, siRNA) precipitate. The standard calcium phosphate transfection method is very easy and straightforward which originally discovered by Graham and van der Ebb (1) and was later modified by Wigler (2). Recently, there have been several approaches to achieve desirable transfection efficiency by changing in experimental conditions to control the size of calcium phosphate and modifying surface of calcium phosphate to enhance cell uptake (4).

The procedure is routinely used to transfect a wide variety of cell types for transient expression or for producing stable transformants. By mixing of calcium chloride solution with nucleic acids and a subsequent addition of phosphate-buffered saline solution results in the formation of fine precipitates (nano- and microparticles). Calcium phosphate transfection complex facilitates the binding of the nucleic acids to the cell surface.

Nucleic acid then enters the cell by endocytosis for transient expression.

Procedure

1. Preparation cultured cells
2. Calcium phosphate-nucleic acid transfection
3. Fluorescence microscopic examination

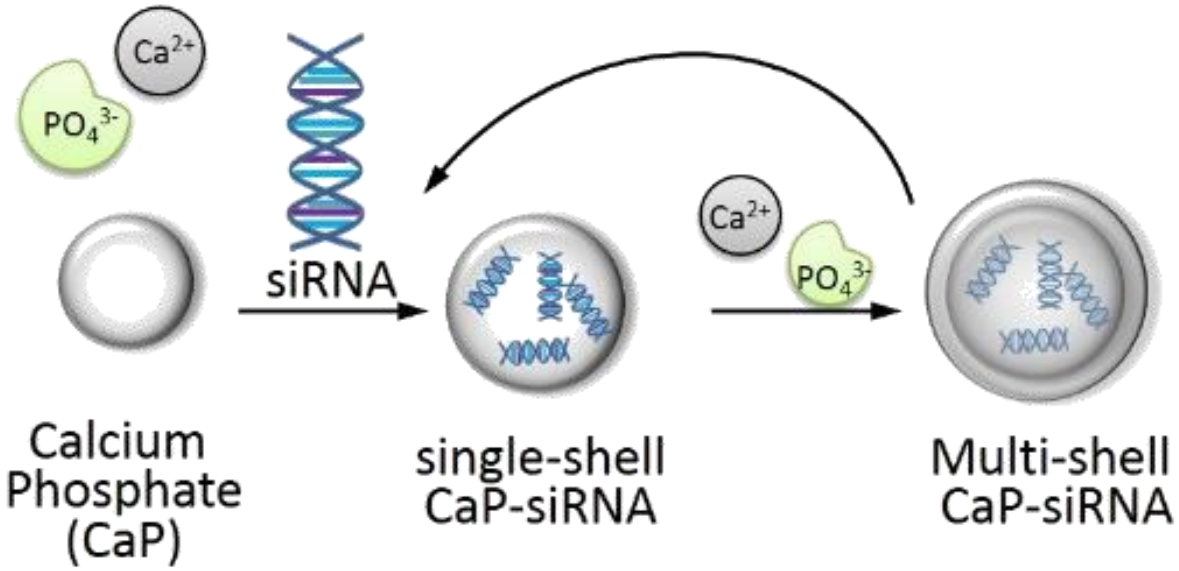


Figure 1. Schematic illustrations of multi-shell CaP-siRNA nanocarrier

References

1. Graham, F. L. and van der Ebb, A. J. (1973) Virology 52: 456.

2. Wigler, M. et al, (1977) Cell 11: 223.

3. Invitrogen™ Calcium Phosphate Transfection Kit

4. Lee, K. et al, (2013) Int J Pharm. 445: 196.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