

## Dedicated Funding Programme for Publicly-funded Schools

Project Number: (To be assigned by the EPMS)  
 Name of School: 優質教育中學  
 Quality Education Secondary School  
 Project Title: STEM 教育之幹細胞科學：發展校本中學幹細胞課程  
 STEM Education with a Focus on Stem Cell Science  
 Beneficiaries: Secondary  
 Estimated Number of Direct Student:600 (6)  
 Beneficiaries: Teacher:4  
 Parent:0  
 Others (Please specify): 0 ( )

### 1. Project Needs

#### 1.1 Project aim(s)

In this Quality Education Fund (QEF) project, our teachers from Department of Biology and Biotechnology will develop a school-based Stem Cell Science curriculum.

The school-based Stem Cell Science curriculum in this QEF project has two domains:

(a) Stem Cell Science lessons for all junior form (S.1-3) students:

The Stem Cell Science curriculum will be designed and integrated into our existing school-based Biotechnology curriculum for all S.1-3 students.

(b) Pull-out gifted programme for scientifically gifted students:

Students who are gifted or have high interest in science will be selected to join a pull-out Stem Cell Science gifted programme.

The aims of our school-based Stem Cell Science curriculum are as follows:

(1) Curriculum for educating all students

To educate all junior form (S.1-3) students to be informed citizens to responsibly deal with stem cell-related issues including scientific and ethical concerns of stem cell application and research by providing Stem Cell Science lessons in S.1-3;

(2) Curriculum for nurturing scientifically gifted students

To nurture students who have strong interest in Stem Cell Science to be aspiring scientists through research-based learning in pull-out research lessons.

#### 1.2 School-based innovative element(s)

This QEF project aims to develop an innovative and pioneer Stem Cell Science curriculum for all junior form students and scientifically gifted learners in a secondary school. The details of the innovative elements of this project are as follows:

(1) STEM education with a focus on Stem Cell Science

The Stem Cell Science curriculum is built with Science, Technology, Engineering and Technology (STEM) elements.

(2) Curriculum of Stem Cell Science for all junior form students

Our proposed Stem Cell Science curriculum is designed for all S.1-3 students. Students will be exposed to three types of enrichment learning activities in S.1-3:

- Type-1 learning activities will target concept-building tasks.
- Type-2 learning activities will involve practical skills of the concepts established in the type-1 learning tasks.
- Type-3 learning activities will help students apply their skills and concepts learnt in type-1 and type-2 lesson activities to solve real problems.

(3) Curriculum of stem cell research programme for scientifically gifted students

We propose to develop the pull-out gifted programme so as to nurture students who are interested in Stem Cell Science.

### 1.3 Meeting with school-based/students' needs

**Item: Relevance to the school development plan of this cycle/major concern**

(1) Our school's mission is to provide ample opportunities for students to develop their potentials and multiple intelligence by facilitating innovative curricula in response to the needs of students and social changes. Our school will establish a new curriculum which helps equip students with necessary knowledge about Stem Cell Science for future personal needs and social changes and develop students' potentials in science especially in the areas of Stem Cell Science.

(2) Our recent school development plans aim to create diverse learning opportunities for students of different interests and career's expectations. In this QEF project, the school-based Stem Cell Science curriculum will create a new learning platform for students to explore stem cell-related studies and careers in universities and in commercial areas.

Our current school-based Science curriculum which is composed of gifted education programme, Biotechnology curriculum, reformed Integrated Science curriculum and Research-based learning programme has been recognised as an innovative curriculum to provide students with extensive science research opportunities. To further develop our Science curriculum, our school will set up a novel Stem Cell Science curriculum which will be integrated into our existing Biotechnology curriculum and Integrated Science curriculum for S.1-3 students. A new branch of pull-out gifted programme will also be developed to nurture aspiring student scientists who are interested in Stem Cell Science.

## 2. Project Feasibility

### 2.1 Key concept (s)/rationale(s) of the project

**Item: Reference pedagogical theories/strategies**

With the experience of our Biology teachers to develop school-based curriculum in science, our school is confident to develop a school-based Stem Cell Science curriculum for all junior form students (S.1-3). We believe that this curriculum can equip students with stem cell-related knowledge and positive attitude to

deal with different personal, social and worldwide contexts in the near future.

The Stem Cell Science curriculum will be integrated into our existing Biotechnology and Integrated Science lessons for all S.1-3 students.

Our school will also develop a pull-out gifted education programme about stem cell research for high achievers in science.

## 2.2 School's readiness

### **Item: Relevant training received/qualifications and experience acquired by teaching staff**

Our teachers in Department of Biology and Biotechnology will be responsible for this QEF project. 4 teachers have strong background in biological sciences and science education.

## 2.3 Principal and teachers' involvement

### **School Staff: Principal**

**Duties:** Formulate plans, Monitor and supervise, Coordinate / collaborate, Process funding

### **School Staff: Project leader**

**Duties:** Formulate plans, Coordinate / collaborate, Process funding, Conduct / participate in activities

### **School Staff: Subject panel head**

**Duties:** Plan curriculum / activities, Conduct / participate in activities, Consolidate learning and teaching materials, Formulate plans

### **School Staff: Subject teachers**

**Duties:** Plan curriculum / activities, Conduct / participate in activities, Consolidate learning and teaching materials

### **School Staff: Subject teachers**

**Duties:** Plan curriculum / activities, Conduct / participate in activities, Consolidate learning and teaching materials

### **School Staff: Laboratory Safety Committee**

**Duties:** Monitor and supervise

## 2.4 Project period

Project Start Date and End Date: from 09/2021 to 08/2023
The project lasts for 2 year(s) and 0 month(s).

## 2.5 Details of project activities

### a. Project implementation measures

<p><b>Activity 1: S.1 Integrated Science</b></p> <p><u>Implementation Period:</u> 09/2022 - 06/2023</p>		
<p><u>Key learning stages and key learning areas/subjects/learning elements</u></p> <ul style="list-style-type: none"> <li>S.1 Integrated Science</li> </ul>	<p><u>Content</u></p> <ul style="list-style-type: none"> <li>nature of stem cells</li> <li>different types of stem cells: embryonic stem cells and adult stem cells</li> <li>potential application of stem cells in medicine</li> <li>public concerns on application of stem cells in medicine</li> <li>ethical and legal issues related to the application of human stem cells in medicine</li> </ul>	<p><u>Number of sessions</u></p> <ul style="list-style-type: none"> <li>6 lessons; 1-hr duration for each lesson</li> </ul>
<p><u>Number of school personnel and/or appointed project staff involved and respective duties:</u></p> <ul style="list-style-type: none"> <li>Our school Biology teachers who are responsible for the development of Stem Cell Science curriculum</li> </ul>		
<p><u>Expected outcomes:</u></p> <ul style="list-style-type: none"> <li>S.1 students will understand what stem cells are and why stem cells can be used in medicine.</li> </ul>		

<p><b>Activity 2: S.2 Integrated Science</b></p> <p><u>Implementation Period:</u> 09/2022 - 06/2023</p>		
<p><u>Key learning stages and key learning areas/subjects/learning elements</u></p> <ul style="list-style-type: none"> <li>S.2 Integrated Science</li> </ul>	<p><u>Content</u></p> <ul style="list-style-type: none"> <li>cell culture system for (rat/mouse) stem cell culture</li> <li>ability of stem cells to develop into different types of cells</li> </ul>	<p><u>Number of sessions</u></p> <ul style="list-style-type: none"> <li>6 lessons; 1-hr duration for each lesson</li> </ul>

	<ul style="list-style-type: none"> <li>• ethical and legal issues related to stem cell research, especially on human stem cell research</li> <li>• concerns related to human stem cell research from scientists, government, legislative departments, commercial organizations, doctors and patients</li> </ul>	
--	---	--

Number of school personnel and/or appointed project staff involved and respective duties:

- Our school Biology teachers who are responsible for the development of Stem Cell Science curriculum

Expected outcomes:

- S.2 students will know what and how stem cell research can be carried out.

**Activity 3: S.3 Integrated Science**

Implementation Period:

09/2022 - 06/2023

<u>Key learning stages and key learning areas/subjects/learning elements</u>	<u>Content</u>	<u>Number of sessions</u>
<ul style="list-style-type: none"> <li>• S.3 Integrated Science</li> </ul>	<ul style="list-style-type: none"> <li>• examples of some genes related to stem cell development</li> <li>• recent discovery of induced pluripotent stem cells (iPSC) to illustrate a new direction of application of stem cells in medicine</li> </ul>	<ul style="list-style-type: none"> <li>• 6 lessons; 1-hr duration for each lesson</li> </ul>

Number of school personnel and/or appointed project staff involved and respective duties:

- Our school Biology teachers who are responsible for the development of Stem Cell Science curriculum

Expected outcomes:

- S.3 students will understand how genes regulate the differentiation and functions of stem cells.

**Activity 4: S.3-6 Integrated Science (Biology)**

Implementation Period:

09/2022 - 06/2023

<u>Key learning stages and key learning areas/subjects/learning elements</u>	<u>Content</u>	<u>Number of sessions</u>

<ul style="list-style-type: none"> <li>S.3-6 Integrated Science / Biology)</li> </ul>	<ul style="list-style-type: none"> <li>Pull-out gifted education programme on stem cell research: S.3 - 6 students who are interested in stem cell research will study the effects of Traditional Chinese Medicine on rat or mouse stem cells' functions and differentiation. Another programme is about tissue engineering by rat or mouse stem cells.</li> </ul>	<ul style="list-style-type: none"> <li>24 lessons; 1-hr duration for each lesson</li> </ul>
---	--	---

Number of school personnel and/or appointed project staff involved and respective duties:

- Our school Biology teachers who are responsible for the development of Stem Cell Science curriculum

Expected outcomes:

- Students will have first-hand experience to do scientific research on stem cells. These students will acquire research experience to be an aspiring scientist.

**b. Teacher training (if applicable)**

**c. Other measures and activities (if applicable)**

## 2.6 Budget

### a. Staff cost

Post title	Full-time equivalent	Appointment requirements	Monthly salary	Mandatory Provident Fund	Employment period (months)	Amount(\$)	Justification
Teaching Assistant	100.0	The qualification of the Teaching Assistant should be a bachelor degree holder. The Teaching Assistant with experience in dealing with teaching materials is preferred.	12,000	600	24	302,400	There will be a lot of administrative work in this QEF project. It is necessary to have a Teaching Assistant to help deal with such administrative work. The concrete duties of the Teaching Assistant are to help organize teaching materials designed by our teachers and handle documentation and other administrative work.
<b>Sub-total on staff cost :</b>						<b>302,400</b>	

### b. Service cost

Item	Service details	Unit cost	Quantity	Unit	Amount(\$)	Justification
<b>Sub-total on service cost :</b>						<b>0</b>

### c. Equipment cost

Item	Specifications	Unit cost	Quantity	Unit	Amount(\$)	Justification
Class II Biosafety Cabinet	Three cabinets can entertain six students to do experiments at the same time.	35,000	3		105,000	Class II Biosafety Cabinets will provide a safe and sterile platform for students, teachers and laboratory technicians to deal with stem cells and their experiments. The model of Class II Biosafety Cabinet which can allow two people to

						work at the same time will be purchased.
CO2 Incubator		40,000	1		40,000	CO2 incubator is used for keeping stem cells at a constant and suitable conditions. It is necessary for all cell culture laboratories.
Live-Cell Imaging System		100,000	1		100,000	Live-cell imaging system provides real-time photos and videos about the development of stem cells at different stages. Changing of experimental conditions may cause morphological changes of stem cells. Real-time observation helps students construct knowledge of complicated developmental stages of stem cells. Some experiments of stem cells may involve overnight incubation and live-cell imaging system provides feasibility to students that they can continue observing the development of stem cells after school.
micropipettes		3,000	4		12,000	In cell culture experiments, accurate transfer of different volumes is needed. Four sets of



						micropipettes allow eight groups of students to conduct experiments at the same time.
<b>Sub-total on equipment cost :</b>						<b>257,000</b>

**d. Works cost**

Item	Works details	Amount(\$)	Justification
<b>Sub-total on works cost :</b>		<b>0</b>	

**e. General expenses**

Item	Amount(\$)	Justification
Culture medium and associated items for keeping stem cells for 2 years (\$500 x 12 months)	6,000	It is necessary to provide cultured cells with appropriate nutrients. Tailor-made culture medium for specific stem cells has to be purchased from biotechnology companies.
<b>Sub-total on general expenses :</b>		<b>6,000</b>

**f. Contingency**

Item	Amount(\$) (Round down to the nearest integer)	
Works contingency	0	
General contingency	7,890	
<b>Sub-total on contingency :</b>		<b>7,890</b>

**g. Audit fee**

	Amount(\$)	
Audit fee	5,000	
<b>Sub-total on audit fee :</b>		<b>5,000</b>
<b>Total amount of funding sought :</b>		<b>578,290</b>

### 3. Expected Project Outcomes

#### 3.1 Deliverables/positive impact on the school's development

**Item: Resource package**

S.1 PowerPoint slides for stem cell science lessons and one set of student handouts will be produced. The topics covered include the nature of stem cells and potential application of stem cells in medicine.

S.2 PowerPoint slides for stem cell science lessons and one set of student handouts will be produced. The topics covered include cell culture system for stem cell culture. A set of safety procedures to carry out stem cell culture will be produced.

S.3 PowerPoint slides for stem cell science lessons and one set of student handouts will be produced. The topics covered include the development of stem cells into different types of cells and ethical and legal issues related to stem cell application and research.

**Item: Strengthened teachers' capabilities in curriculum design and teaching**

(1) Enrichment of existing Integrated Science curriculum and Senior Secondary Biology curriculum

(2) Promotion of STEM education

Our school-based Stem Cell Science curriculum contains STEM elements which can promote students' STEM literacy. The Stem Cell Science lessons provide a learning platform for students to develop STEM literacy.

(3) Enhancement of students' quality in terms of scientific and ethical concerns

One of our missions in science education is to educate and nurture informed citizens who are able to make responses wisely and responsibly towards various personal and social issues. We believe that our Stem Cell Science curriculum will provide students with necessary knowledge, skills and responsible attitude towards future stem cell-related issues.

#### 3.2 Evaluation

**Evaluation Method: Lesson/activity observation****Success criteria:**

- Our school has set up quality assurance mechanism to assure the quality of each lesson. Peer lesson observation is one of the methods applied in the quality assurance mechanism. In peer lesson observation, our Biology teachers will study the learning difficulties of students in each of the topics in the Stem Cell Science lessons.
- Success criteria: Students in Stem Cell Science lesson are engaged in active learning on stem cell topics.

**Evaluation Method: Lesson/activity observation****Success criteria:**

- In quality assurance mechanism in our school, lesson study is also applied for the development of teaching strategies for promoting learning and teaching effectiveness.
- Success criteria: Specific teaching strategies are established for teaching stem cell science and ethical and social issues about stem cell applications.

**Evaluation Method: Questionnaire****Success criteria:**

- Questionnaire on students' understanding on stem cells and stem cell-related issues. This survey aims to study the effectiveness of our school-based Stem Cell Science curriculum to educate students to be more informed in the area of Stem Cell Science and stem cells' ethics and applications.

**Evaluation Method: Focus group interview**

**Success criteria:**

- Some students will be selected to be interviewed. The objective of the interview is to study students' view on this new school-based curriculum.
- Success criteria: Interview of students is done and some comments are collected for further development of the Stem Cell Science curriculum.

**3.3 Sustainability of the project (only applicable to applications with total funding sought exceeding \$200,000)**

- The project will be extended to other classes/levels/subjects.

**3.4 Dissemination (only applicable to applications with total funding sought exceeding \$200,000)**

**Item: Seminar/sharing session**

A seminar will be organised to disseminate our Stem Cell Science curriculum.

**Item: Workshop**

Two workshops about the practical tasks in our Stem Cell Science curriculum will be organized for secondary school teachers.

**Item: Learning circle**

Some teaching materials will be uploaded to our school webpage so that other teachers can download the materials as a reference for the development of their school-based Stem Cell Science curriculum.

**When writing this proposal, did the school refer to the sample proposal/project(s) approved with funding support at the Quality Education Fund (QEF) website?**

No