

## Regenerative Medicine Minnesota Progress Report

*Due one month after your grant's end date or after payout of grant, whichever comes first.*

**Project Title: Saint Mary's University of Minnesota's Advancing Regenerative Medicine Program**

**Award #: RMM-2016-EP-03**

**Prepared by: Todd A. Reinhart, ScD, Dean of Sciences and Health Professions; 18 August 2017**

**Brief Description of Project:** The Advancing Regenerative Medicine (ARM) educational program was designed to increase the understanding of regenerative medicine by college biology/biochemistry students who had completed two to three years of study in their programs. This was achieved through interactive lecture/discussion sessions in the mornings, each led by an expert in the field, and then afternoon hands-on laboratory sessions in fundamental methods in the area of regenerative medicine. The program, designed and executed by Saint Mary's University Biology faculty members, ran from the evening of May 29 through midday June 09 (a schematic of the **schedule is appended** at the end of this report). A total of nine (9) guest expert lecturers led interactive learning sessions, coming from Mayo Clinic, The University of Minnesota, Iowa State University, The Karolinska Institutet, Gundersen Health System's Kabara Cancer Institute, and UNC Chapel Hill. Based on informal feedback during the workshop and a formal, anonymous survey at the end of the program, the program was highly successful and well received, paving the way for a second workshop in 2018 that will be improved based on this inaugural run.

**Where did this project take place?** The ARM workshop was held on the Winona campus of **Saint Mary's University of Minnesota** in the recently dedicated and newly opened Science and Learning Center, which contains 50,000 square feet of state-of-the-art laboratories and classrooms. In addition, a trip was made to visit the Center for Regenerative Medicine at Mayo Clinic, paired with a visit to Saint Mary's University's Cascade Meadow facility in Rochester for a lunch meeting with a bioethicist from Mayo Clinic.

**People impacted by project and where they are from:** As with any potentially transformative learning experience, ALL participants, including teachers and learners, should feel the impact, and this is what was achieved through this ARM program. The **students were highly impacted** by this program. All 19 student participants provided anonymous feedback at the end of the two week workshop and as summarized in the next section, the student participants had highly positive experiences that for some, led them to state that they were going to change their fall course schedule in preparation for moving their major course of study in a different direction. The faculty leaders from Saint Mary's University were highly impacted by this experience because it offered opportunities to create and run new laboratory modules on basics in cell culture, transfection, flow cytometry, and real-time RT-PCR. All of these methods were new to 17 or more of the student participants. We were kindly provided a four-color flow-cytometer for demo and use during the workshop by MilliporeSigma and it was a wonderful addition and opportunity of the workshop. None of the student participants had worked with a flow cytometer previously.

In addition, we expect that there was some impact on the guest expert lecturers as they prepared lecture/engagement activities for an undergraduate audience. Finally, we suggest that the student participants will take what they learned through the ARM program back to their home institutions and have indirect effects on their interactions with course materials, peers, and faculty starting this fall semester.

**What was the outcome of the project?** The ARM program worked-out well in-line with how we had originally envisioned it. We created an environment in which experts in the field interacted directly with mid-level undergraduates and shared their expertise on RM, interspersed with hands-on modules of fundamental experimental approaches to addressing RM issues in the laboratory.

We performed pre- and post-workshop surveys and although there is extensive analysis still needing to be done, the workshop was very well received. With the 18 post-workshop surveys received, 17 participants selected “strongly agree” in response to the prompt “This workshop was worth my time and effort” and the other participant selected “agree”. In addition, in response to the prompt asking “the extent to which they found the **laboratory exercises** provided a positive learning experience,” of the 18 post-workshop surveys received, 14 participants selected “strongly agree” for all four laboratory units and three participants selected a mix of “strongly agree” and “agree”. One participant wrote in “life changing” for two of the laboratory units and selected “strongly agree” for the other two. The laboratory units were: (1) cell culture and transfection; (2) RNA isolation and RTqPCR; (3) splenocyte generation, staining, and flow cytometry; and (4) iPSC staining and flow cytometry.

Interestingly, participants scored themselves fairly high on the extent to which they felt they understood RM at the start of the workshop. This increased after the workshop, although it is likely they over-estimated their understanding of RM at the outset of the two weeks. In the future, we will drill down more deeply and build a set of RM inventory items to actually test their understanding of key, fundamental concepts at the start and end of the workshop.

Twelve of 18 participants “strongly agreed” that the **two week duration** of the ARM workshop was the right length, five “agreed”, and one “disagreed” – the latter noting under additional comments that they “wouldn’t have minded if the workshop was longer”.

Therefore, the ARM program was a resounding success and we intend to build upon this solid, test-run foundation going forward, hopefully in spring of 2018. The program worked as we expected and students learned much. Successes include the student experiences and the development of laboratory modules. There were no major failures in the program, although the laboratory module seeking to de-differentiate murine liver cells by co-transfection of plasmids expressing the Yamanaka factors did not lead to evidence of change toward greater stemness. We now have identified improved laboratory methods to achieve and demonstrate this. Also, the students were not universally supportive of having to write a 10 page group paper in addition to a final group presentation. Additionally, some students were not supportive of the video presentation that Fan Yang created on organotypic culture model building and sent from UNC Chapel Hill.

The impact on RM in Minnesota is that 19 undergraduate students studying in seven different institutions are now much more fully aware of basic concepts in RM from basic stem cell biology to clinical applications, and have an RM-like filter through which they will be completing their coursework, undergraduate research, and choosing and completing advanced studies.

**Please list any of the following that have resulted from your Regenerative Medicine Minnesota grant funding:** As this was an educational award, there have been no publications, manuscripts, patents or additional grant applications resulting from this project yet.

**Responsible Spending:** The funds so generously provided were used well in alignment with what we proposed. Because Saint Mary’s University provided room and board as part of our institutional commitment, funds were underspent slightly and only \$94,769.49 (direct plus indirect costs) were invoiced of the \$98,280 awarded. The major expenditures have receipts, packing slips, and/or accounting documentation and included (numbers rounded):

\$19,000	Student stipends (19 at \$1,000 each)
\$10,000	Guest lecturer stipends and travel
\$13,000	Saint Mary’s University faculty stipends (four faculty members in total)
\$23,000	Lab supplies, equipment, team building activities, final banquet, advertising.

# Appendix: ARM 2017 Program Schedule

	Monday 29-May	Tuesday 30-May	Wednesday 31-May	Thursday 1-Jun	Friday 2-Jun	Saturday 3-Jun	Sunday 4-Jun	Monday 5-Jun	Tuesday 6-Jun	Wednesday 7-Jun	Thursday 8-Jun	Friday 9-Jun
8:00		Breakfast In the dorm	Breakfast In the dorm	Breakfast In the dorm	Breakfast In the dorm	Breakfast 7am-8am Toner	Breakfast 7am-8am Toner	Breakfast In the dorm	Breakfast In the dorm	Breakfast In the dorm	Breakfast In the dorm	Breakfast In the dorm
9:00		Introductions, Program Overview, Ice Breakers				Day off from programming	Canoeing, kayaking, paddle board Lake Park 9:30-11:30					
10:00		Dr. Saranya Wyles: Program Overview/Ice Breakers SLC 208	Dr. Brenda Ogle SLC 208	Ms. Charlotte Feedersen SLC 208	Mayo Visit 9-12	Dr. Michael Yaszemski SLC 208		Dr. Anne Gingery SLC 208	Dr. Mattias Svensson SLC 208	Dr. Paraic Kenny SLC 208	Dr. Todd Reinhardt SLC 208	Group Presentation: Organ-specific Regenerative Medicine SLC 208
11:00												
12:00		Lunch 11:30-12:30	Lunch 11:30-12:30	Lunch 11:30-12:30		Lunch 11:30-12:30	Lunch 11:30-12:30	Lunch 11:30-12:30	Lunch 11:30-12:30	Lunch 11:30-12:30 Cardinal Club	Lunch Cardinal Club 11:30- 12:30	Lunch Cardinal Club 11:30- 12:30
1:00		Overview of Group Projects/presentations; Lab Safety. SLC 208	Flow cytometry: spleenic cells SLC 109	Flow cytometry: spleenic cells SLC 109	Box Lunch	Museum, biking the lakes, hiking the bluffs,	Museum, biking the lakes, hiking	mRNA isolation/RT SLC 107	qRT-PCR SLC 107	qRT-PCR Analysis SLC 107	qRT-PCR Analysis SLC 109	
2:00		Over view on cell culture SLC 208	Culture of Liver Cells SLC 104	Transfection of Liver Cells SLC 104	Cascade Meadow Dr. Allyse Ethics		Museum, biking the lakes, hiking	Flow cytometry Liver iPS cells SLC 109	Flow cytometry Liver iPS cells SLC 109	Flow cytometry Liver iPS cells SLC 109	Feedback from Faculty on Presentation Preparation	
3:00		Culture Cells SLC 104	Flow cytometry: spleenic cells SLC 109	Transfection of Liver Cells SLC 104	Return to Winona			mRNA isolation/RT SLC 107	Flow cytometry Liver iPS cells SLC 109	Flow cytometry Liver iPS cells SLC 107		
4:00		Intro to Flow cytometry SLC 109	Culture of Liver Cells SLC 104	Flow cytometry: spleenic cells SLC 109	Dinner 5:30-6pm			Flow cytometry Liver iPS cells SLC 109	qRT-PCR SLC 107	Mr. Fan Yang (via video/email) SLC 208		
5:00		Dinner 5:30-6pm	Dinner 5:30-6pm	Dinner 5:30-6pm	Dinner 5:30-6pm	Grillout at DJM	Dinner 5:30-6pm	Dinner 5:30-6pm	Dinner 5:30-6pm	Dinner 5:30-6pm Cardinal Club	Program Wrap up/Group Pic	Departures
6:00	5-7 The Pines Arrivals/Check in/Registration Pizza (7pm)	Movie	ropes course/bowling	ropes course/bowling				Students work on presentation	Students work on presentation	Students work on presentation	Banquet 5:30 Toner Center Lounge	
7:00								Students work on presentation	Students work on presentation	Students work on presentation	Dr. Mattias Svensson Plenary TC Lounge	