



November 11, 2013

Re: Nord Grant Applications

Phone 216-368-5590

E-mail: nicole.steinmetz@case.edu

www.steinmetzlab.com

www.thenanoman.org

Dear UCITE Committee Members:

We seek funding for the continuation of our emerging and successful project THE NANOMAN. THE NANOMAN is a multimedia outreach program that aims to integrate nanomedicine into education (K-12, undergraduate, graduate) and the arts. The goal is to introduce novel concepts of how to think about and approach sciences and engineering by interfacing STEM field with the performing arts, digital video, and gaming disciplines. THE NANOMAN was funded through a Nord Grant in 2013. With support of the Nord Grant, we have held several workshops, which led to the development of two educational animated videos, a music video, and the script for a live theatrical musical! Since this is a renewal grant application, we start out with a progress report followed by an outline of the specific aims for 2014!

Progress Report:

We established collaboration with award-winning NYC-based musical theatre writing team Knight & Brinegar (letter of collaboration attached) and created **THE NANOMAN**. THE NANOMAN is a multidisciplinary project that bridges the fields of biomedical engineering (Steinmetz), gaming and graphic design (Brinegar), and theatre (Knight). Our tiny superhero, THE NANOMAN, is on an important mission to deliver highly toxic chemotherapeutic drugs to cancerous tissue, while avoiding healthy cells. THE NANOMAN faces various challenges and biological barriers on its journey and fight with cancer. In video clips, music videos, video games, and live incarnations, we aim to make the science accessible. We use story, music, and interactivity to explain the challenges of current cancer treatments, the engineering principles that can be applied to enhance cancer therapy, with the ultimate goal to increase patient survival.

Our target audiences are K-12 students, undergraduate and graduate students, as well as the general public. To reach this diverse target group, we are developing a multifaceted program. We have shared our video clips with the STEM director Patty Hunt (Hathaway Brown), who is excited to incorporate the program into STEM classes. At CWRU, I have used the videos in lectures and seminars teaching undergraduate and graduate level classes (e.g. EBME105, EBME426, EBME570) with great success. Colleagues in other departments also incorporated the videos in their lectures (e.g. EMAC426). Such enthusiastic feedback from institutions, faculty, and students has encouraged us to further develop NANOMAN.



Figure 1: THE NANOMAN logo.

In 2013, we focused on three areas:

Videos: Our debut animated video THE NANOMAN (watch it on YouTube.com or TheNanoman.org) has had more than 2,500 views. Our second video **THE NANOMAN SUPER ROCKET RACERS GP** was launched in August 2013 and has received more than 250 views. Both videos are well received in the arts, gaming, and scientific communities. For example, Dr. Steinmetz presented the videos at the 2013 Drug Delivery Symposium as well as Gordon Conference of Cancer Nanotechnology; as a result, we were contacted by the **National Cancer Institute**, who were interested to highlight our work on their outreach webpage. As of last week, both video clips are now embedded on the **Dialogue on Cancer Nanotechnology** website:

<https://nanocancer.ideascale.com/a/pages/cancer-nano-videos!>

This is a huge accomplishment and honor and will increase the visibility of THE NANOMAN as well as Case Western Reserve University and the UCITE program. The Nord Grant is gratefully acknowledged in the video produced under the tenure of the grant, THE NANOMAN SUPER ROCKET RACERS GP, as well as on affiliated webpages, publications, announcements, and press releases (a press release is planned to announce the success of bringing THE NANOMAN to NCI!).

I Gaming: During 2013, we focused on the development of novel characters and scenes, as can be seen in the video THE NANOMAN SUPER ROCKET RACERS GP. We have delayed the release in order to launch the game on multiple (iOS/android/web/pc/mac) platforms. **The prototype video game was on interactive display at our New York City workshop.** Based on feedback from users playing the prototype, we aim to add additional levels and complexity so that the user will continue to visit the game after the first experience. We plan to launch this coming year with a 10-level THE NANOMAN 1.0 game (see proposed objectives for 2014).

II Theatre: In 2013, we held two workshops, one in NYC in April hosted by PAGE73 and co-supported through a Creative Spaces Grant and another at Berkeley Repertory Theatre in August. As a result of the exciting progress made this year, we will release a **Music Video** detailing the manufacturing and engineering of nanoparticles from plants; PROPAGATION-PURIFICATION-BIOCONJUGATION-CHARACTERIZATION SONG. The audio has been recorded, and we are finalizing the edits of the accompanying video (with pictures and video scenes from the Lab). The proposed publication date is mid-December 2013.

In summary, the Nord Grant 2013 has enabled us to make progress and move projects forward efficiently! The Nord Grant renewal would allow us to continue this exciting collaboration and innovative work. To supplement the Nord Grant, we also have applied for funds from the National Science Foundation, and are submitting proposals to The Sloan Foundation, Mabou Mines Theatre Company, and The Brooklyn Arts Exchange, among others. For 2014, we have outlined plans to increase our visibility through coveted promotional materials as well as publicizing new projects in press releases. THE NANOMAN is already implemented in classes taught at CWRU; our goal is to further its impact by introducing THE NANOMAN to local and then national high schools as well as a national audience eager for material intersecting storytelling and science.



Figure 2: Screenshots from THE NANOMAN videos.

The specific objectives for 2014 are:

Objective 1: Video 500 USD

Continue our series of animated educational videos and incorporate online tutorials. In education, the use of video provides a way of engaging a large and diverse audience. Videos can be accessed and shared via computers, phones, and tablets. To utilize this interconnectivity and accessibility, *we plan to produce a third 3-minute video*, continuing with the characters and visual aesthetic of the first two videos, but highlighting a different scientific question or engineering principle, e.g. DRUG RESISTANCE. This new video will be accompanied by 5-10 min tutorials by Dr. Steinmetz and/or her students. Dr. Steinmetz mentors 2 post-graduate, 2 graduate, and 10 undergraduate students; the outreach program is directly linked to Dr. Steinmetz research program and graduate and undergraduate students are involved in research and educational training.

Milestones and budget: Publish a third video accompanied by a tutorial during the funding period. **500 USD** are requested for story development, graphic design, and editing.

Objective 2: Interactive Video Game 1000 USD

Implement a NANOMAN video game. The published NANOMAN videos are a snapshot of the visual world of the game. The goal is to teach the students basic concepts of drug delivery through an interactive gaming experience. In the game, the student can then choose a particular player (e.g. different shaped nanocarrier equipped with different tools, targeting spears to enter cells, or various drugs). The chosen player then has to navigate the biological barriers (e.g. macrophages) and fight the cancer. The video game will build on the graphics and stories introduced in the series of videos. Students will be directly involved in the development. Student players will be recruited from the Steinmetz Lab, the BME program and other CWRU students campus-wide. We will also include student players from local high schools (e.g. Hathaway Brown). The game will be launched on TheNanoman.org webpage and we will allow players to provide comments to help refine and develop the game. Also, students working in nanomedicine will be recruited as scientific advisors and work with Dr. Steinmetz to keep the game scientifically rigorous.

Milestones and budget: Develop a NANOMAN video game for iOS/android/web/pc/mac platform and launch a full version of the freeware by the end of the tenure of this grant. **1000 USD** are requested for development and programming.

Objective 3: Theater 3,000 USD

Develop a Live Theatrical Work. The objective is to join the STEM discipline with the visual and performing arts. The play in development is a collaboration with Playwright Knight and Composer/Graphic Artist Brinegar (letter attached). ***The goal is to bring our early draft of the piece, framed as a theatrical lecture, to production-ready draft.*** By combining cutting-edge research with innovative theatre, we want to create a live experience that is more interactive, engaging, and entertaining than a typical lecture and more informative and educational than at typical play—something that would be at home but still be groundbreaking in a TED Talk or a downtown NY theater space. In a tight, compelling narrative, THE NANOMAN will communicate with his creator, Dr. X, as they develop new engineering tools for The NANOMAN to fight cancer. Several venues have been identified to perform and develop this theatrical/scientific hybrid: HB's annual black box theater and science fair, Northeast Ohio Regional Science Olympiad, and E-Week: National Engineers Week is celebrated annually on CWRU campus. Clips of the play will be filmed and popularized through platforms such as YouTube.

Milestones and budget: Create and develop a 40-min theatrical lecture. We request a total of **3,000 USD** to cover further script and music development (1,000 USD) and design, production, and publicity costs (2,000 USD).

Objective 4: Promotional Materials 500 USD

Funds are requested for promotional materials, such as buttons, stickers, magnets, and balloons. We will use these promotional materials to help popularize the project and build its following across disciplines.

In summary, we are highly committed to this exciting project. The laboratory of Dr. Steinmetz is actively working on reaching a wide audience. For example, at the Biomedical

*Engineering Society Meeting the Lab Members appeared in jackets promoting the program. A total of **5,000 USD** is requested to further this comprehensive outreach program to teach our students and the general public about the exciting developments in nanomedicine.*

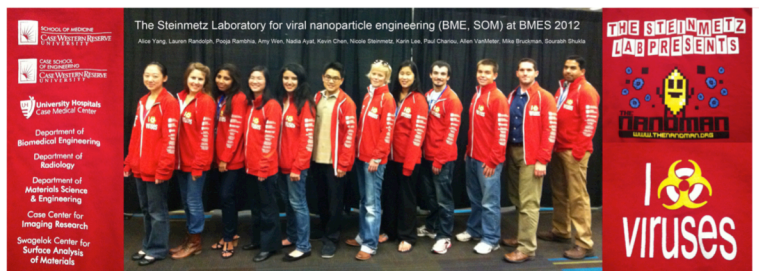


Figure 3: Steinmetz Lab and THE NANOMAN at BMES.

We appreciate your consideration of our application. We would be happy to provide additional information if requested.

Best wishes

A handwritten signature in black ink, appearing to read 'N. Steinmetz'.

Nicole F. Steinmetz, Ph.D.,
Assistant Professor of Biomedical

Knight & Brinegar

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November 11, 2013

To the UCITE Committee:

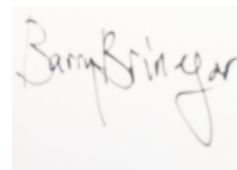
This letter serves to confirm our enthusiasm to continue the outreach program THE NANOMAN with Dr. Steinmetz.

As *Knight & Brinegar*, we are a retro-forward musical writing team. The production of THE NANOMAN videos and early development of the theatrical piece have been an exciting experience and proof that successful and innovative storytelling and education can come from this collaboration. *The theatre piece has been a finalist for several prestigious artistic development opportunities and we have been approached by The Impact Theatre in San Francisco interested in hosting the premiere production this summer when the piece is ready to be tested in front of an audience!* We look forward to the third video in the series and launching the video game, which will enrich the audience's relationship to THE NANOMAN across platforms. The collaboration with Dr. Steinmetz has been instrumental in our work and we look forward to continue this exciting collaboration.

Sincerely,



Krista Knight



Barry Brinegar