

# Idaho Incubation Fund Program

## Final Report Form

Proposal No. IF14-002  
Name: Dr. Greg Hampikian  
Name of Institution: Boise State University  
Project Title: Liposome Nullomer Peptides

Information to be reported in your final report is as follows:

1. Provide a summary of overall project accomplishments to include goals/milestones met, any barriers encountered, and how the barriers were overcome:
  - I. Tried several formulations of liposome delivery, each had some drawbacks. We got around these by using a combination of Tween and Trehalose to dissolve the peptides.
  - II. Determined that Nullomer peptide 9S1 is effective at 20uM against 95% of the 60 cancer cell lines tested using combinations of trehalose and Tween.
  - III. Demonstrated that Nullomer peptides are effective against drug resistant ovarian and colon cancers.
  - IV. Improved the efficacy of the nullomer peptides by the elongation of the cell penetrating arginine tail (from 5 to 7 Args), and by the addition of two Glycines to provide flexibility to the peptide
  - V. Designed and tested a new Nullomer 7R-GG-118 which is the most effective to date. This Nullomer kills cancers that are resistant to 9S1 and 9R, and is effective at lower doses than other Nullomers on most cancers
  - VI. Demonstrated ATP loss in cancer cells exposed to Nullomer peptides for just two hours, with no effect seen in fibroblasts

Describe the current state of the technology and related product/service:

### **Nullomer Peptides Have Broad Anticancer Effects**

Table 1 shows the results of that testing, and categorizes the response of each of the NCI-60 cell lines to the 3 initial anticancer Nullomer peptides. The NCI-60 comprises human cancer cells from nine organ systems: kidney, prostate, ovary, hematopoietic system, colon, skin, breast, nervous system and lung. We are currently completing our testing of these peptides on a series of normal cell lines as well. Our Pardee Foundation work has shown that the vast majority of NCI-60 cancer types (94.74%) are sensitive to 9S1 at 20  $\mu$ M. At this concentration, peptide 9R was effective against 68.42% of the NCI-60 lines. All 60 lines are resistant to peptide 124R, which is a 10 amino acid-length Nullomer that serves as control in our studies. Sensitivity to both 9R and 9S1R is shared by 66.67% of the NCI-60 cancer lines. Cancers that are sensitive to 9S1R but resistant to 9R make up 28.07% of the NCI-60 panel; while only one cell line HCC 2998 (colon cancer) is 9R sensitive and 9S1R resistant. Two cell lines A549 (lung cancer) and HT-29 (colon

cancer) are resistant to both 9R and 9S1R. We have categorized sensitivity to 9R and 9S1R in Table 1. Cancers that are sensitive to both are designated I, to only 9S1 are II, to only 9R are III, and to neither are IV.

		9R	9S1R	124R	Category
<b>Kidney</b>	SN12C, CAKI-1	+	+	-	I
	786-0, UO-31, A498, TK-10, RXF393	-	+	-	II
<b>Leukemia</b>	RPMI 8226 HL-60 (TB), MOLT-4, CCRF-CEM, K-562	+	+	-	I
<b>Ovarian</b>	NCI/ADR-RES, OVCAR-5, OVCAR-3, OVCAR-4, OVCAR-8	+	+	-	I
	SK-OV-3	-	+	-	II
	IGR-OV1	-	+	-	II
<b>Melanoma</b>	LOX-IMVI, M14, UACC-62, SK-MEL-2	+	+	-	I
	MDA-MB-43, SK-MEL-28	-	+	-	II
<b>Breast</b>	MDA-MB-231, BT-549, MDA-MB-468	+	+	-	I
	T-47D	-	+	-	II
<b>Colon</b>	SW-620, HCT-116, COLO 205, HCT-15	+	+	-	I
	HCC-2998	+	-	-	III
	HT-29	-	-	-	IV
<b>Lung</b>	HOP62, EK VX, NCI-H460	+	+	-	I
	NCH-H522, NCI-H23, NCI-H226, HOP92, NCI-H322M	-	+	-	II
	A549 ATCC,	-	-	-	IV
<b>Prostate</b>	DU-145	+	+	-	I
	PC-3	-	+	-	II
<b>CNS</b>	SNB-19, SF-295, U251, SF-539, SNB-75	+	+	-	I
	SF-268	-	+	-	II

**Table 1. Sensitivity of the NCI-60 Cancer Cell Lines to Nullomers 9R, 9S1 and 124.**

- Breast cancer triple negative cancer cells (estrogen-, progesterone-, and Her-2neu) MDA MB 231 and MDA MB 468 are sensitive to both 9S1R and 9R.
- Prostate androgen-resistant cancer cells PC-3 and DU 145 are both sensitive to 9S1R.
- Ovarian drug-resistant cancer cells (adriamycin resistant): NCI/ADR-RES are sensitive to both 9S1R and 9R.
- Lung cancer stem-cell-like cancer cells NCI-H460 are sensitive to both 9S1R and 9R.

2. List the number of faculty and student participants as a result of funding:

2 Faculty members

4 Undergraduate research students (independent research credits and presentations at the Undergraduate Research Symposium)

3. What are the potential economic benefits:

The Silver Bullet drug that affects all (or many) forms of cancer has proven elusive. Our Nullomer drugs have broad anticancer effects as seen in the table above.

4. Description future plans for project continuation or expansion: We are moving to complete testing several new Nullomer Drugs against our NIH-60 panel and to estimate the doses for planned animal experiments.

5. Please provide a final expenditure report (attached) and include any comments here:
  
6. List invention disclosures, patent, copyright and PVP applications filed, technology licenses/options signed, start-up businesses created, and industry involvement:  
We have modified our patent application for these drugs (through BSU) to include the new Nullomer drugs.
  
7. Any other pertinent information: We continue to search for investors, and have met with several potential funders and developers.

**FINAL EXPENDITURE REPORT**

<b>A. FACULTY AND STAFF</b>		
Name/Title	\$ Amount Requested	Actual \$ Spent
Dr. Greg Hampikain, Professor	8,001.00	8,001.00
<b>B. VISITING PROFESSORS</b>		
Name/Title	\$ Amount Requested	Actual \$ Spent
<b>C. POST DOCTORAL ASSOCIATES/OTHER PROFESSIONALS</b>		
Name/Title	\$ Amount Requested	Actual \$ Spent
Dr. Abdelkrim Alileche, Assistant Research Professor	5,888.00	4,107.20
D		
<b>D. GRADUATE/UNDERGRADUATE STUDENTS</b>		
Name/Title	\$ Amount Requested	Actual \$ Spent
Joelene Krantz, Graduate Student		1,039.00
		1,039.00
<b>E. FRINGE BENEFITS</b>		
Rate of Fringe (%)	\$ Amount Requested	Actual \$ Spent
Dr. Hampikian (23%) Dr. Alileche (42%) Joelene Krantz (1%)	3,132.00	3,594.48
<b>PERSONNEL SUBTOTAL:</b>	<b>17,021.00</b>	16,741.68
<b>F. EQUIPMENT: (List each item with a cost in excess of \$1000)</b>		
Item/Description	\$ Amount Requested	Actual \$ Spent
1.		
2.		
3.		
4.		
<b>EQUIPMENT SUBTOTAL:</b>		
<b>G. TRAVEL</b>		
Description	\$ Amount Requested	Actual \$ Spent
1. Dr. Hampikian, Intl Symposium Human ID, Atlanta, Georgia October 2013	2,700.00	1,574.47
2.		
3		
<b>TRAVEL SUBTOTAL:</b>	2,700.00	1,574.47

<b>H. PARTICIPANT SUPPORT COSTS:</b>			
Description		\$ Amount Requested	Actual \$ Spent
1. Peptides and Cell Culture Materials		23,779.00	16,157.85
2.Sonicator For Liposome Production		1,000.00	1,000.00
3.Lab Chemicals and Supplies for Liposome Manufacture		5,500	14,526.00
<b>PARTICIPANT SUPPORT COSTS SUBTOTAL:</b>		\$30,279.00	
<b>I. OTHER DIRECT COSTS:</b>			
Description		\$ Amount Requested	Actual \$ Spent
1.			
2.			
3.			
<b>OTHER DIRECT COSTS SUBTOTAL:</b>			
<b>TOTAL COSTS (Add Subtotals):</b>			
<b>TOTAL AMOUNT REQUESTED:</b>			\$50,000.00
<b>TOTAL AMOUNT SPENT:</b>			\$50,000.00