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Award Number: DAMD17-98-1-8295

TITLE: Targeted Therapy of Human Breast Cancer by 2-5A-Antisense Directed Against Telomerase RNA

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REPORT DATE: September 2001

TYPE OF REPORT: Annual

PREPARED FOR: U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 2001	Annual (1 Sep 00 - 31 Aug 01)

4. TITLE AND SUBTITLE
Targeted Therapy of Human Breast Cancer by 2-5A-Antisense Directed Against Telomerase RNA

5. FUNDING NUMBERS
DAMD17-98-1-8295

6. AUTHOR(S)
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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army Medical Research and Materiel Command
Fort Detrick, Maryland 21702-5012

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; Distribution Unlimited

12b. DISTRIBUTION CODE

13. Abstract ***(Maximum 200 Words)*** *(abstract should contain no proprietary or confidential information)*
Targeting telomerase RNA (hTR) for degradation by RNAseL in breast cancer cells using antisense molecules linked to 2-5A has demonstrated high levels of cytotoxicity *in vivo* and *in vitro*. The antisense molecules used in preliminary studies carried a phosphodiester backbone which can be recognized by endogenous nucleases and so make the half-life of these molecules very short. Having demonstrated *in vitro* that breast cancer cells undergo apoptosis following this treatment, we now sought to improve the stability of the antisense molecules by modifying the backbone. The phosphodiester linkages were therefore replaced with thioate or 2'-0-methyl linkages in various combinations. Many of these modifications resulted in the loss of ability to induce apoptosis in breast cancer cells. Although some of the modified oligonucleotides showed reasonable degrees of cytotoxicity, none of these were as efficient as the original (H1) phophodiester version of the oligonucleotide. When new targets within hTR were challenged with 2-5A-linked molecules, none showed any improvement over H1. We conclude that the H1 antisense molecule has the greatest specificity but that its efficacy is less if the backbone structure is changed either because of a reduced affinity for the target sequence or a reduced ability to activate RnaseL.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Breast Cancer	5
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	Unlimited

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INTRODUCTION:

Telomerase is the riboprotein enzyme complex which prevents the ends of chromosomes from shortening below a critical length in cancer cells. This enzyme is normally not expressed in the majority of human cells after an early point in embryonic development but is reactivated in the vast majority (95%) of highly malignant cancer cells. It is thought to be an essential requirement for the maintenance of cell viability in cancer cells which express it. We have investigated whether inactivating telomerase in cancer cells using an antisense oligonucleotide approach targeting the RNA component of the enzyme will result in cell death. The oligonucleotides used carry a 2-5A moiety attached to the antisense molecule. 2-5A activates endogenous RNAseL which is normally found as an inactive monomer in the cytoplasm in most cells. In the presence of 2-5A the monomer dimerizes and become a potent RNAse. Thus, the antisense molecule targets a specific RNA and the recruitment of RNAseL then selectively degrades the target. The overall aim of the project, therefore, is to determine whether inactivating telomerase can be developed as a viable form of anti cancer therapy for breast tumors. The initial series of experiments are designed to establish the conditions of treatment which will produce effective cell killing. In the last report we demonstrated that 2-5A-anti-hTR treatment of human breast cancer cell lines resulted in rapid cell death in vitro which was due to the induction of apoptosis. When tumors were induced in the flanks of nude mice and treated by direct injection of the antisense oligonucleotides, tumor development was retarded compared with control animals. We had thus demonstrated that growth of human breast cancer cell lines could be prevented by treating with an antisense oligonucleotide targeting the RNA component of telomerase.

BODY:

In October 2000 the P.I. accepted the position of Chair of Cancer Genetics at Roswell Park Cancer Institute and moved his laboratory there in November 2000. The USAMRMC was informed of this change of institution at that time and the paperwork to transfer the grant funding was submitted at the beginning of 2001. As of the 30th of September 2001 this transfer has still not taken place and no assurances that it will be completed could be obtained. As a consequence we have been unable to pursue any of the experimental objectives outlined in the statement of work for the final year of this grant. The outstanding tasks therefore remain as they did at the end of the second year.

Task 1: Completed
Task 2: Completed
Task 3: In progress
Task 4: Completed
Task 5: Completed
Task 6: Completed
Task 7: Completed
Task 8: Suspended due to the nuclease sensitivity of the oligos
Task 9: Not initiated
Task 10: Not initiated

We are in a position to undertake the analyses as described in the original application which is dependent on the transfer of the remaining funding for the project to hire personnel who will be dedicated to this task.

KEY RESEARCH ACCOMPLISHMENTS:
No progress due to the non-transfer of funding to the new Institution.

REPORTABLE OUTCOMES:
No progress due to the non-transfer of funding to the new Institution.

CONCLUSIONS:
No progress due to the non-transfer of funding to the new Institution.

REFERENCES:
None

APPENDICES
None