GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[x] ORIGINAL [ ] REVISION NO. ______

Project No.: Main Project G-41-D04/Wartell/Physics
Sub. G-32-D04/Biology

DATE 6/21/82

Project Director: Dr. Rodger M. Wartell

School/~~Lab~~ Physics/Biology

Sponsor: DHEW/PHS/NIH - National Institute of Allergy & Infectious Diseases

Type Agreement: Grant No. 5 K04 AI00332-04 (year 04)

Award Period: From 7/1/82 To 6/30/83 (Performance) 9/30/83 (Reports)

Sponsor Amount: $36,155 ($27,117 in G-41-D04) ($9,038 in G-32-D04)

Contracted through: ~~GTRI~~/GIT

Cost Sharing: None

Title: Interaction of RNA Polymerase with DNA Sites

ADMINISTRATIVE DATA

OCA Contact William F. Brown x4820

1) Sponsor Technical Contact: Program Official
Irving F. DeLappe, Ph. D. Chief
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2) Sponsor Admin/Contractual Matters: Grants Mgt.
Gary E. Thompson/Todd Ball
Grants Management Branch
EAP-NIAID
Bethesda, MD 20014
(301) 496-7075

Defense Priority Rating: None

Security Classification: None

RESTRICTIONS

See Attached NIH Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval — Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with GIT, but none proposed

COMMENTS:

RECEIVED Research Reports Office

COPIES TO: RAN (Physics/Bio)

~~Administrative Coordinator~~
Research Property Management
Accounting
Procurement/EES Supply Services
Research Security Services
Reports Coordinator (OCA)
Legal Services (OCA)
Library
EES Public Relations (2)
Computer Input
Project File
Other G-32-D04 file

FORM OCA 4:781

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 11/9/84

Project No. G-41-D04 School/~~Lab~~ Physics

Includes Subproject No.(s) G-32-D04/Wartell/Biology

Project Director(s) Dr. R. M. Wartell ~~GTRI~~ / GIT

Sponsor DHEW/PHS/NIH - Nat'l Institute of Allergy & Infectious Disease

Title Interaction of RNA Polymerase with DNA Sites

Effective Completion Date: 6/30/83 (Performance) 6/30/83 (Reports)

Grant/Contract Closeout Actions Remaining:

- [x] None
- [ ] Final Invoice or Final Fiscal Report
- [ ] Closing Documents
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

Continues Project No. G-41-D03

Continued by Project No. G-41-D05 and sub. G-32-D05 (THESE WERE TERMINATED 10/30/84)

COPIES TO:

Project Director
Research Administrative Network
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Accounting
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Library
GTRI
Research Communications (2)
Project File
Other A. Jones; M. Heyser

APPLICANT: REPEAT GRANT NUMBER SHOWN ON PAGE 1

SECTION IV—SUMMARY PROGRESS REPORT

GRANT NUMBER	AI00332-05	
PERIOD COVERED BY THIS REPORT	FROM: July 1, 1982	THROUGH: June 30, 1983

PRINCIPAL INVESTIGATOR OR PROGRAM DIRECTOR (Last, First, Initial)

Wartell, Roger M.

NAME OF ORGANIZATION

Georgia Institute of Technology

TITLE (Repeat title shown in Item 1 on first page)

Interaction of RNA Polymerase with DNA Sites

List all publications not previously reported resulting from work supported by this grant (author(s), title, page numbers, year, journal or book). List manuscripts separately as submitted for publication or accepted for publication.
Provide two reprints of publications not previously submitted to the awarding unit.
Progress Report (See instructions)

I. Publications not previously reported

"Influence of Base Pair Changes and Cooperativity Parameters on the Melting of Short DNA's", A. S. Benight and R. M. Wartell, Biopolymers (1983), in press.

Reprints of 3 previously reported publications from 1982 enclosed.

II. Progress Report

One objective of the project is to determine thermodynamic and conformational properties of the short regions of DNA which are recognized and bound by RNA polymerase to initiate transcription. A second objective, which developed during the course of the grant period, is to examine the junction between two very different DNA conformations, the left-handed helical Z conformation and the right-handed B conformation. During the past year progress was made in Raman spectroscopy studies on DNA fragments containing the transcription initiation region of the E coli bacteria's lactose operon. Raman spectroscopy was also used to examine the B to Z transition of the DNA polymer $(dG\text{-}dC)_n \cdot (dG\text{-}dC)_n$.

Raman spectra were obtained from two DNA restriction fragments 95 bp. and 144 bp. in length and five heterogeneous sequence DNAs of varying G·C % content. The two fragments contain the E. coli lactose, lac, operon transcription start region. These DNAs were obtained by genetic cloning techniques. The heterogeneous DNAs were obtained from commercial sources. Computer analysis procedures were used to quantify Raman band intensities for over 17 bands lying between 400-1300 cm^{-1}. These bands correspond to both DNA base and backbone vibrations. Previous studies have shown that a DNA's Raman spectra provides a 'fingerprint' for the DNA structure. One can readily distinguish between A, B, and Z conformations. Plots were made of the Raman intensity of specific bands vs. % GC for the 7 DNAs examined. For all of the Raman bands examined, the two lac DNA fragments behaved as B conformation DNAs. One can determine if a DNA has 20% A or Z type conformation. The salt induced B to Z transition of $(dG\text{-}dC)_n \cdot (dG\text{-}dC)_n$ was followed by Raman spectroscopy. Transition curves of base and backbone band intensities were measured as a function of sodium ion concentration. The results show that several base vibrations changed in intensity prior to any change of a phosphate vibration at 1093 cm^{-1}. The 1093 cm^{-1} band shows a relatively sharp intensity change (a 0.3 M Na^+ interval) when compared to several bands associated with base stacking (intensity changed over a 1.2 M Na^+ interval). The data suggests that changes in base stacking initiates the B to Z transition. Further analysis of Raman band intensity changes are underway.

Plans for the coming year include a continuation of the analysis of the B to Z transition in $(dG\text{-}dC)_n \cdot (dG\text{-}dC)_n$ as measured by Raman spectroscopy and a similar study of $(dG\text{-}dC^{Me})_n \cdot (dG\text{-}dC^{Me})_n$. Studies of the transition in D_2O will be examined. This may allow the determination of the state of base pair hydrogen bonding during the transition, and the effect of methyl-cytosine on the transition.

Preliminary experiments will be made on the interaction of the protein CAP (catabolite activator protein) with the lac DNA fragments. This protein enhances RNA polymerase binding to the transcription start region. These studies will examine the effect of CAP on the melting behavior of the 144 bp. lac DNA fragment, and a 64 bp. subfragment of this DNA which contains the CAP site.

Research Development

Several activities were carried out which benefited research skills. In order to obtain a "hands on" understanding of DNA sequencing techniques several afternoons were spent in the laboratory of Dr. Cyrus Cabradella of the Center of Disease Control in Atlanta. This technique is being used in my lab to obtain the nucleotide sequence of several isolated DNA fragments. Visits were made to light scattering laboratories at the University of Rochester (Dr. D. H. Turner) and the University of Florida (Dr. H. Van Wort) to learn about instrumentation and techniques which could be applied to kinetic Raman spectroscopy studies. Informal discussions with colleagues at Georgia Tech, Dr. N. Yu and Dr. D. C. O'Shea have also been highly beneficial. Other activities which increased research skills were attendance of various seminars within the Atlanta area and the Biophysical Society meeting in California in February 1983 and a Gordon Research Conference in New Hampshire in June 1982.

Other Activities

During the past year I participated in teaching and a few administrative activities. One course was taught in the fall quarter (Phys. 3121 Classical Mechanics) and a course and lab were taught in the spring quarter (Phys. 4253 Biophysics II). I was a member of the departmental Graduate Student Committee and Faculty Search Committee as well as the Institute's Biotechnology Committee. Teaching activities required approximately 40% of time available during the quarters the courses were taught. The percentage of time spent on administrative activities was about 5%. Participation in the teaching program helps to reinforce an understanding of the physical and chemical principles underlying research. Additionally, the biophysics courses are essential parts of the degree option in biophysics.

Wartell, Roger M. Grant No. AI00332-05

Georgia Institute of Technology

Awardee's planned involvement in non research activities

Dr. Wartell will continue to participate in teaching and administrative activities of the department. The precentage of time spent in these activities will be at a reduced level to allow for research and research development. He will participate in the instructional program during the spring quarter next year, and contribute to departmental administrative duties as a member of the Graduate Student Committee, Resource Committee and Faculty Advisory Committee. Comittee work will require approximately 5% of time available for professional activities. Approximately 40% of time will be spent in instructional activity during the quarter in which he will be teaching. These duties are similar to those pursued by all faculty and are necessary for Dr. Wartell's continued progress and promotion prospects.

Signed,

Edward W. Thomas

Edward W. Thomas
Director, School of Physics