09:03:11 OCA PAD INITIATION - PROJECT HEADER INFORMATION 06/08/89

Active

Project #: G-33-A14 Cost share #: Rev #: 0
Center # : 246Q5250-4A0 Center shr #: OCA file #:
Work type : RES
Contract#: 5 R01 EY01746-14 Mod #: Document : GRANT
Prime #: Contract entity: GIT

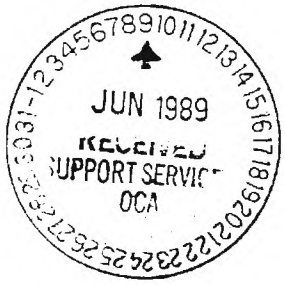
Subprojects ? : N
Main project #:

Project unit: CHEM Unit code: 02.010.136
Project director(s):
YU N-T CHEM (404)894-4007

Sponsor/division names: DHHS/PHS/NIH / NATL INSTITUTES OF HEALTH
Sponsor/division codes: 108 / 001

Award period: 890501 to 900430 (performance) 900731 (reports)

Sponsor amount	New this change	Total to date
Contract value	205,138.00	205,138.00
Funded	205,138.00	205,138.00
Cost sharing amount		0.00



Does subcontracting plan apply ?: N

Title: COMPARATIVE RAMAN STUDIES OF HUMAN AND ANIMAL LENSES

PROJECT ADMINISTRATION DATA

OCA contact: Kathleen R. Ehlinger 894-4820

Sponsor technical contact

PETER A. DUDLEY, PH.D.
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BETHESDA, MD 20892

Sponsor issuing office

CAROLYN E. GRIMES, GRANTS MGMT OFR
(301)496-5884
EXTRAMURAL SERVICES BR/NEI/NIH
5333 WESTBARD AVE
BETHESDA, MD 20892

Security class (U,C,S,TS) : U
Defense priority rating : N/A
Equipment title vests with: Sponsor GIT X

ONR resident rep. is ACO (Y/N): N
NIH supplemental sheet

Administrative comments -
14TH YEAR OF GRANT.

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION

NOTICE OF PROJECT CLOSEOUT

Closeout Notice Date 06/29/90

roject No. G-33-A14_____ Center No. 246Q5250-4A0_____

roject Director YU N-T_____ School/Lab CHEM_____

ponsor DHHS/PHS/NIH/NATL INSTITUTES OF HEALTH_____

ontract/Grant No. 5 R01 EY01746-14_____ Contract Entity GIT_

rime Contract No. _____

itle COMPARATIVE RAMAN STUDIES OF HUMAN AND ANIMAL LENSES_____

ffective Completion Date 900430 (Performance) 900731 (Reports)

loseout Actions Required:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	Y	_____
Final Report of Inventions and/or Subcontracts	N	_____
Government Property Inventory & Related Certificate	N	_____
Classified Material Certificate	N	_____
Release and Assignment	N	_____
Other _____	N	_____

CommentsCONTINUED BY G-33-A15._____

ubproject Under Main Project No. _____

ontinues Project No. G-33-A13_____

istribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	N
Project File	Y
Other _____	N
_____	N

G 33-A14

SECTION IV PROGRESS REPORT SUMMARY	GRANT NUMBER EY01746-15	
PRINCIPAL INVESTIGATOR OR PROGRAM DIRECTOR Yu, Nai-Teng	PERIOD COVERED BY THIS REPORT FROM	THROUGH
APPLICANT ORGANIZATION Georgia Institute of Technology	05/01/89	02/20/90

TITLE OF PROJECT *(Repeat title shown in item 1 on first page)*
Comparative Raman Studies of Human and Animal Lenses

(SEE INSTRUCTIONS)

1. **The Plans for the Next Year of Support:**

The specific aims for the next year of support are : (1) To continue FT-Raman studies of human brunescence cataracts with more sensitive Bruker FT-Raman spectrometer; (2) To study fluorescent lipid peroxidized products by the FT-Raman method; (3) To interpret the 406.7nm-excited fluorescence images of human lenses and compare them with those obtained at 350-365 nm excitation; (4) To continue our development of the techniques of near infrared-excited surface-enhanced Fourier-Transformed Raman spectroscopy for the detection of 3-OH-L-kynurenine-O-β-glucoside and its derivatives.

2. **Concise Description of the Studies Conducted during the Current Budget Year:**

a) *Development of New Technique: Near Infrared FT-Raman Spectroscopy for Cataractous Human Lenses*

We finally overcome the major difficulty in Raman spectroscopic studies of older and cataractous human lenses, especially the brunescent cataracts. These lenses exhibit high fluorescence with visible excitations. Previous attempts to obtain Raman spectra from senile cataractous lenses or normal human lenses older than 58 years were unsuccessful due to fluorescence interference. We now have obtained , for the first time, high quality Raman spectra of these lenses with a new technique: near infrared-excited Fourier transform (FT)-Raman spectroscopy. This technique employs excitation at 1.064 μm, of which the photon energy is too low to excite fluorescence. For the purpose of human lens studies, near-IR FT-Raman spectroscopy is definitely the best technique since it combines fluorescence rejection, in-situ applicability, and the multiplex / throughput advantages afforded by the Michelson interferometer over a conventional dispersive Raman spectrometer. The FT-Raman spectra can be further improved by the Bruker FT-Raman spectrometer that is much more sensitive than the Bomem DA3.02. Any lenses and their isolated constituents are now amenable for Raman studies.

b) *Surface-enhanced Raman Spectra of Eye Lens Pigments*

Surface-enhanced Raman spectroscopy (SERS) has been applied to study lenticular pigments that are present in the eyes of certain diurnally active animals. Using Ag hydrosols pre-aggregated with $NaClO_4$, we have obtained SERS spectra from dilute solutions of various model pigment compounds, including kynurenine, N-formylkynurenine, 3-hydroxykynurenine, β-carboline, bityrosine, anthranilic acid, 3-hydroxyanthranilic acid and oxindole. The results obtained from these model compounds show that SERS is a particularly sensitive technique for the identification of lens pigments. We also find a procedure that enables high-quality SERS data to be obtained for the yellow pigments in the lens homogenates of grey squirrels, ground squirrels and chipmunks. The surface Raman results confirm the identity of the low molecular weight, water soluble pigment in the grey squirrel lens as a derivative of 3-hydroxykynurenine, but reveal that lens pigmentation in ground squirrels and chipmunks involves new chromophores.

c) *Localization of UV-induced Changes in Mouse Lens*

We have compared the opacity produced by UV with that produced by X-ray in animal models. The first appearance of UV-induced cataract is in the deep cortical region and has essentially the same near-spherical symmetry as the lens itself. However, X-ray cataract appears in the posterior cortex. We reason that this difference in location must be due to procedural differences. X-rays are given as a short intense dose which is followed by a latent period of perhaps months before the opacity becomes apparent. The injured epithelial cells migrate from the anterior to the posterior where they appear as a posterior cataract. On the other hand, the UV dose is weak but long-continued so that the cataract produced represents the accumulation of injured cells all along the migration path of cells elongating as they become fiber cells. The oldest cells continue to receive radiation but at an intensity which continually decreases as they fall in the shadow of younger, newly irradiated cells. Thus the shape of the opacity is that of a near-sphere surrounding a core of clear fibers which were never irradiated as epithelial cells and surrounded by much younger cells which have not yet received enough radiation to produce a visible effect. We have obtained Raman evidence to support the above interpretation.

3. No change

4. Not Applicable

5. **Publications:**

i) Yu, N.-T., Barron, B. C. and Kuck, J. F. R., Jr. (1989) "Distribution of Two Metabolically Related Fluorophors in Human Lens Measured by Laser Microprobe" **Exp. Eye Res.** *49*, 189-194.

ii) Cai, M.-Z., Kuck, J. F. R., Jr. and Yu, N.-T. (1989) "Galactose-induced Cataract in Rat: Raman Detection of Sulfhydryl Decrease and Water Increase along an Equatorial Diameter" **Exp. Eye. Res.** *49*, 531-541.

iii) Yu, N.-T., DeNagel, D. C. and Slingsby, C. (1989) "Raman Spectroscopy of Calf γ-II Crystallin: Direct Evidence for the Formation of Mixed Disulfide Bonds with 2-Mercaptoethanol and Glutathione" **Exp. Eye. Res.** *48*, 399-410.

iv) Yu, N.-T., Bando, M. and Kuck, J. F. R., Jr. (1990) "Localization of UV-induced Changes in Mouses Lens" **Exp. Eye. Res.** (in press).

v) Nie, S., Bergbauer, K. L., Kuck, J. F. R., Jr. and Yu, N.-T. (1990) "Near Infrared Fourier Transform Raman Spectroscopy in Human Lens Research" **Exp. Eye. Res.** (in press).

vi) Nie, S., Castillo, C. G., Bergbauer, K. L., Kuck, J. F. R., Jr., Nabiev, I. R. and Yu, N.-T. (1990) "Surface-Enhanced Raman Spectra of Eye Lens Pigments" **Appl. Spectrosc.** (in press).

vii) Nie, S., Bergbauer, K. L., Ho, J. J., Kuck, J. F. R., Jr. and Yu, N.-T. (1990) "Application of Near-Infrared Fourier Transform Raman Spectroscopy on Biology and Medicine" **Spectroscopy** (in press).