AANAPISI STEM & McNair Scholars
Summer 2023 Research Institute

Program Handbook

University of Nevada, Las Vegas
Center for Academic Enrichment & Outreach

4505 S. Maryland Parkway
Box 452006
Las Vegas, NV 89154-2006
Campus Location: SSC-A 301

Program Overview
Administered through UNLV's Center for Academic Enrichment and Outreach (CAEO), the AANAPISI STEM, and McNair Scholars Summer Research Institute (SRI) offers eligible undergraduates in CAEO's AANAPISI STEM and McNair projects the opportunity to conduct research under the guidance of a faculty mentor. The SRI program, lasting the duration of the summer, provides students with a series of training activities and assignments designed to help students gain insight into research at UNLV. By participating in undergraduate research, students are exposed to the process of scholarly inquiry and develop a host of skills related to critical thinking, academic writing, and presenting research.

Program Guidelines
1. There are no set hourly requirements for student-faculty research—each academic discipline lends itself to unique research hours. Hourly commitments are established through student-faculty agreements. However, if an SRI student has concerns about the hours he or she is asked to commit to research work, the student should discuss the matter with Terri Bernstein, Assistant Director for the McNair Scholars Institute & Undergraduate Research..
2. Each SRI student will receive a stipend of $2,800 to support research activities during the summer. Disbursement of the stipend occurs through three equal payments of about $933.33 rather than as a lump sum via UNLV's Financial Aid & Scholarships office. These will be issued on the first working Thursday of each month upon completion of program milestones, with the total amount of the payments being $2,800.
3. Each SRI mentor will receive incentive funds totaling $750. Note: Only persons currently employed by the Nevada System of Higher Education (NSHE) are eligible to receive incentive funds for serving as an SRI faculty mentor. While an SRI student can be mentored by a non-NSHE faculty member, that faculty member will not receive incentive funds.
4. SRI participants must use their UNLV email accounts for all SRI-related correspondence.

SRI Student Expectations
1. Each student must prepare a **research poster** to be presented at the CAEO undergraduate research symposium.
2. Each student must complete a full **manuscript** detailing the research conducted during the Summer Research Institute. The manuscript must be approved by the student's faculty mentor and will be published in the *CAEO Undergraduate Research Journal* (non peer-reviewed).
3. Each student must attend the **training activities** and complete the **assignments** specified on pages 4 and 5 of this *Program Handbook.*
4. Each student must participate in the monthly **peer-mentoring group meetings** (handouts are provided).
5. Each student must respond to **weekly google surveys** regarding their SRI progress.
6. Each student must participate in monthly **mandatory check-in meetings** with program staff.

SRI Faculty Mentor Expectations
1. Faculty mentors are expected to meet regularly with their mentee students to discuss their research projects.
2. Faculty mentors are expected to ensure that their mentee students receive proper guidance and supervision to successfully meet the outcomes described in the students' application/project descriptions.

Program Support
In addition to faculty mentors, the following staff members are available to provide support for students involved in research:

CAEO Undergraduate Research & McNair Scholars Institute
Terri Bernstein *Assistant Director for McNair Scholars Institute & Undergraduate Research* **Contact:terri.bernstein@unlv.edu** **Office: 702/895-4776** **Cell: 702/491-6259** **Hours:** Available by appointment

Activities/Assignments	Date	Time	Venue
May			
Individual SRI Orientation Sessions	5/30-6/2	Varies	Zoom
June			
Pre-Survey	6/2/2023	11:59 PM	Canvas
Weekly Scholar Progress Report	6/2, 6/9. 6/16, 6/23, 6/30, 7/7, 7/14, 7/21, 7/28, & 8/4	11:59 PM	Canvas
Complete Training/Certification Requirements (e.g. IRB)	June 9, if applicable. Discuss with mentor.		
Workshop: "Planning Your Research: Developing a Research Timeline"	6/16/2023	10:00 AM	Canvas
Workshop: "Introduction to the Library Databases"	6/23/2023	10:00 AM	Canvas
Research Guide/Timeline	6/9/2023. Complete with mentor.		
"Meet the Librarian" Form	June 30. Submit only if you did not attend the "Introduction to the Library Databases" workshop.	11:59 AM	Canvas
Mandatory Monthly Check-In Meeting	Meet with Terri no later than 6/30.	Varies	Zoom/In-Person
Peer Mentoring Group Meeting	Must occur no later than 6/30. Submit sign-in sheet.	Varies	In-Person
Manuscript Outline: Introduction	6/30/2023	11:59 AM	Canvas
July			
1st Scholar Stipend Payment	7/6/2023		
Mentor Interview	7/14/2023	11:59 PM	Canvas
Workshop: "Outlining and Drafting Your Research Paper"	7/14/2023	1:00 PM	Canvas
Scholar & Mentor Progress Reports	7/21/2023	11:59 PM	Canvas
Graduate School Admissions Boot Camp	7/21/2023	TBA	TBA
Manuscript Draft: Methods	7/28/2023	11:59 PM	Canvas
Mandatory Monthly Check-In Meeting	Meet with Terri no later than 7/31.	Varies	Zoom/In-Person
Peer Mentoring Group Meeting	Submit sign-in sheet	Varies	In-Person
August			
2nd Scholar Stipend Payment	8/4/2023		
Workshop: "Designing Your Research Poster"	8/18/2023	1:00 PM	Canvas
nuscript Draft: Results/Discussion/Conclusion/Future Direct	8/25/2023	11:59 PM	Canvas
Poster Draft	9/1/2023	11:59 PM	Canvas
Peer Mentoring Group Meeting	Submit sign-in sheet.	Varies	
Mandatory Monthly Check-In Meeting	Meet with Terri no later than 8/31.	Varies	Zoom/In-Person
September			
3rd Scholar Stipend Payment	9/7/2023		
Final Poster Due	9/8/2023	11:59 PM	Canvas
Final Paper with Signed Mentor's Approval Sheet Due	9/15/2023	11:59 PM	Canvas
Post-Survey	9/22/2023	11:59 PM	Canvas
Fall 2023			
Present at Research Symposium	TBA		

Examples of Research Posters

Interactions between T-Cell Death Associated Gene 51 (TDAG51) and Tubby Proteins

Christopher D. Williams, Lorena P. Samentar, and Nora B. Caberoy, Ph.D.
School of Life Sciences, University of Nevada, Las Vegas

INTRODUCTION

- Mutations within Tubby protein
  - Responsible for retinal degeneration, hearing loss, and obesity
  - Mechanisms of disease pathogenesis are not fully understood
- The Caberoy Lab used an open-reading frame (ORF) phage display to identify proteins that interact with Tubby
- Protein interactors can reveal pathways Tubby is involved in
- TDAG51 or Pleckstrin-Homology Like Domain Family A member 1 (PHLDA1)
  - conserved proline-histidine rich nuclear protein responsible for apoptotic effects in T cells
  - putative Tubby binding partner
  - shares pathways shown to be affected by mutations in Tubby
- **Project goal: To demonstrate the interaction of Tubby and TDAG51**

METHODS

Identification and characterization of TDAG51 as Tubby-binding protein

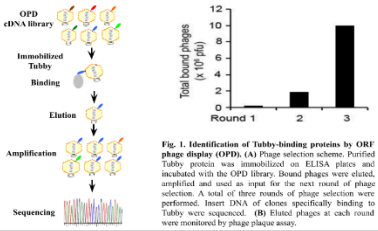

Fig. 1. Identification of Tubby-binding proteins by ORF phage display (OPD). (A) Phage selection scheme. Purified Tubby protein was immobilized on ELISA plates and incubated with the OPD library. Bound phages were eluted, amplified and used as input for the next round of phage selection. A total of three rounds of phage selection were performed. Insert DNA of clones specifically binding to Tubby were sequenced. **(B)** Eluted phages at each round were monitored by phage plaque assay.

Cloning of TDAG51 / **Co-immunoprecipitation (Co-IP)**

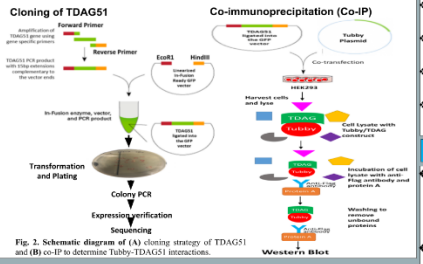

Fig. 2. Schematic diagram of (A) cloning strategy of TDAG51 and **(B)** co-IP to determine Tubby-TDAG51 interactions.

SUMMARY

- TDGA51 was identified as a putative Tubby-binding protein by ORF phage display.
- TDAG51 and TDAG51ΔPH were successfully cloned into universal GFP vector and expressed in HEK293 cells.
- Tubby-TDAG51 interaction was independently validated by co-immunoprecipitation
- PH domain of TDAG51 is necessary for its binding with Tubby.

Future Directions

- **Determination of Tubby domain that binds to TDAG51.**
  - Co-IP of TDAG51 with Tubby N and Tubby C terminal only
  - Protein pull-down assay using purified proteins
- **Characterization of Tubby-TDAG51 co-localization** using immunohistochemistry and confocal microscopy
  - Cellular model – Neuro2A
  - Animal model – brain and retina of WT and Tubby mice

RESULTS

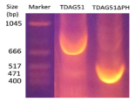

Figure 2. 816 base pairs (bp) TDAG51 and 495 bp TDAG51ΔPH were amplified by PCR. Agarose gel electrophoresis results, visualized under UV light, of PCR amplification using gene specific primers.

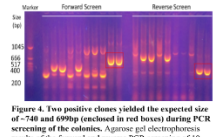

Figure 4. Two positive clones yielded the expected size of ~740 and 699bp (enclosed in red boxes) during PCR screening of the colonies. Agarose gel electrophoresis results of the forward and reverse PCR screening of 10 colonies using sequence specific primers.

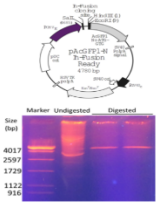

Figure 3. pAcGFP1-N In-Fusion Ready Vector was linearized after digestion with EcoRI and HindIII restriction enzymes. A. Schematic diagram of the GFP vector. **B.** Agarose gel electrophoresis results showing the GFP vector after digestion with the undigested vector as control.

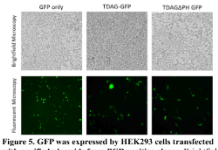

Figure 5. GFP was expressed by HEK293 cells transfected with purified plasmids from PCR positive clones. Brightfield and fluorescent photomicrograph of HEK293 cells transfected with GFP only, TDAG-GFP and TDAGΔPH-GFP. Bright-field images are shown for comparison.

Figure 6. GFP fused Ha-TDAG51 (~60kDa) and Ha-TDAG51ΔPH (~45kDa) proteins were expressed by HEK293 cells. HEK293 cells were transfected with purified plasmids, harvested, and lysed. Western blot analysis using mouse anti-Ha mAb antibody detected TDAG51 and TDAG51ΔPH. Ha-GFP (~27kDa) was used as control.

ClustalW Multiple Sequence Alignment

```
TargetSeq       CTGCCATGCTGGAGAACAGCGGCTGCAAGCGCTGAAGGAAGGAGTGCTGG ...
TDAGdelta_Clone CTGCCATGCTGGAGAACAGCGGCTGCAAGCGCCTG----------------- ...
TDAG_Clone      CTGCCATGCTGGAGAACAGCGGCTGCAAGCGCTGAAGGAAGGAGTGCTGG ...
                ********************************                  ***

TargetSeq_TDAG  ... TGGTGATGACGGAGGGCAAAGAGATCGACTTTCGGTGCCCCCAGGACCAGG
TDAGdelta_Clone ... ----------------------------------CCCAGGACCAGG
TDAG_Clone      ... TGGTGATGACGGAGGGCAAAGAGATCGACTTTCGGTGCCCCCAGGACCAGG
                                                    ************
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Figure 7. The sequence of TDAG51 and TDAG51ΔPH is identical to the target sequence. Portion of the ClustalW 2.1 multiple sequence alignment results showing the sequence of the TDAG51 clone with the target sequence for TDAG51, and the upstream and downstream regions with deletion of the PH domain for TDAG51ΔPH.

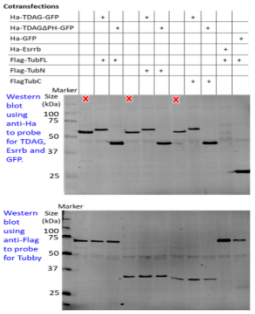

Figure 8. Both Tubby and TDAG51 proteins were expressed by HEK293 cells upon co-transfections. HEK293 cells were co-transfected with Tubby and TDAG51 plasmids, harvested, and lysed. Mouse anti-Ha mAb antibody was used to detect TDAG51, Esrrb, and GFP for Western blot analysis. Esrrb and GFP co-transfection were used as controls. These successful co-transfections were then used for co-IP.

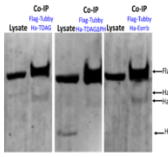

Figure 9. Flag-Tubby interacts with Ha-TDAG51 but not with Ha-TDAG51ΔPH *in vivo*. Co-immunoprecipitation with anti-Flag antibody and protein A beads was done using lysate of cells that expressed both Tubby and TDAG51. Western blot analysis was done using both anti-Flag and anti-Ha antibodies to detect Tubby and TDAG, respectively. Esrrb which was used as the positive control did not show a prominent band in the lysate but displayed a prominent band in the co-IP. Whole cell lysate was also loaded as reference.

References

1. Caberoy, N. B. *et al.* (2010). *J. Mol. Recognit.* 23, 74-83.
2. Nagai, M. (2016). *Biomed. Reports* 10.3892/br.2016.580
3. Carroll, K.J. *et al.* (2004). *Nat. Rev. Molec. Cell Biol.*, *5*, 55-64.
4. Caberoy, N. B. *et al* (2010). *The EMBO Journal*, 29(23), 3898–3910.

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THE TESHIK-TASH CHILD: EVOLUTIONARY MONTAGE DURING THE MIDDLE PALEOLITHIC

Nirosh Moodley & Alesha Pettit
Department of Anthropology & Ethnic Studies, University of Nevada-Las Vegas

Background

Discovered in 1938 in the Bajsun district of southern Uzbekistan, Teshik-Tash 1 represents a juvenile male hominin, aged between nine and eleven years old. He was classified as *Homo neanderthalensis*. Two pertinent characteristics of the find's in situ context provided the backdrop for this classification. Firstly, the Teshik-Tash child was buried with associated grave goods surrounded by a Middle Paleolithic assemblage which has been described as "Mousterian-like" (Glantz et al, 2009: 48). Secondly, the very location of this find was the furthest eastern extent of hominin discoveries outside of the Levant. Recent research, however, challenges this boundary by questioning whether Teshik-Tash 1 is truly a Neanderthal specimen (Glantz, 2008). The Teshik-Tash juvenile is thus an important fossil to understand the dynamics and possible cultural links between the hominins of the Near East and those of Central Asia.

The Site

- Single, deliberate burial
- Three cultural layers[1]
- Middle Paleolithic assemblage
- Mousterian-like lithics
- Ritual artefacts: grave goods?
- Neanderthal burial?

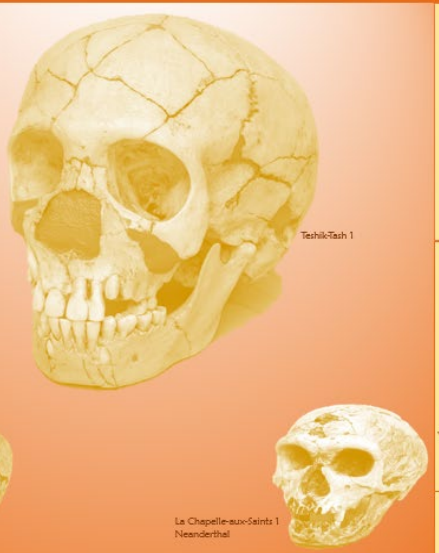
The Cranium

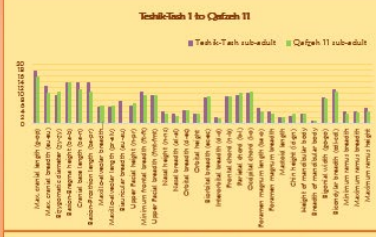
- Severely crushed; possible animal attack
- Original reconstruction flawed
- Mosaic morphology (Glantz, 2009)
- Not wholly Neanderthal
- Neanderthal, early modern human or transitional?

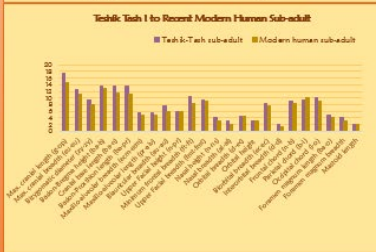
Methods

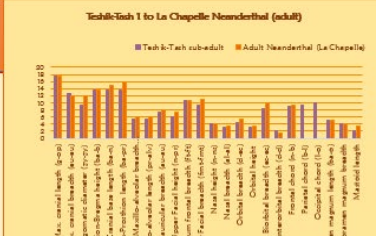
- Thirty-three craniofacial measurements: Bulkstra and Ubelaker (2004)
- Comparison to
  - Qafzeh 11 juvenile early modern human
  - Juvenile modern human
  - Adult modern human
  - La Chapelle Neanderthal
  - La Ferrassie Neanderthal

[1]Okladnikov AR 1999. Natkhodka Neandertal'tsa v Uzbekistane. *Istorik Drevnei Istorii* 1:253-257.









Results

- Mosaic craniofacial anatomy
- Close similarity to Qafzeh 11, La Chapelle-aux-Saints I
- Larger than modern human sub-adult
- Close similarity to adult modern human
- Dental eruption = same as modern human

Conclusions

- Clear example of mixed traits
- Illustrates variability in Late Pleistocene hominin record
- Cannot be termed wholly Neanderthal or wholly modern human

Implications

- Challenging for comparison: scarcity of Central Asian finds
- More research necessary to draw further conclusions
- Valuable study for phylogenetic tree

Further References

Glantz, M., Athreya, S., & Ritzman, T. (2009). Is Central Asia the Eastern Outpost of the Neanderthal Range? A Reassessment of the Teshik-Tash Child. *American Journal of Physical Anthropology*, *139*(1), 48-8.

Glantz, M., Viola, B., Wrinn, P., Chikisheva, T., Derevianko, A., Krivoshapkin, A., Ritzman, T. (2008). New hominin remains from Uzbekistan. *Journal of Human Evolution*, *55*(2), 223-237.

Bulkstra, J.E. and Ubelaker, D.H. 2004. Standards for Data Collection from Human Skeletal Remains. Archaeological Survey Research Seminar Series 44, Fayetteville.

Weidenreich, F. (1945). The Paleolithic Child from the Teshik-Tash Cave in southern Uzbekistan (Central Asia). *American Journal of Physical Anthropology*, *3*(3), 151-162.

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