AWARD NUMBER: W81XWH-19-1-0562

TITLE: Transcription Factor Analysis of SLE

PRINCIPAL INVESTIGATOR: Kathleen E. Sullivan

CONTRACTING ORGANIZATION: The Children's Hospital, Philadelphia, PA

REPORT DATE: October 2022

TYPE OF REPORT: Annual

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

REPORT DOCUMENTATION PAGE	*Form Approved OMB No. 0704-0188*

1. REPORT DATE	**2. REPORT TYPE**	**3. DATES COVERED**
October 2022	**Annualal**	**15Sep2021-14Sep2022**

4. TITLE AND SUBTITLE

Transcription Factor Analysis of SLE

5a. CONTRACT NUMBER
W81XWH-19-1-0562

5b. GRANT NUMBER
LR180127

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Kathleen E Sullivan

E-Mail:Sullivank@chop.edu

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

The Children's Hospital of Philadelphia
34th St and Civic Ctr. Blvd.
Philadelphia, PA 19104

Johns Hopkins Univ. Sch. Med.
725 N. Wolfe St.
Baltimore, MD 21205

8. PERFORMING ORGANIZATION REPORT

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Medical Research and Development Command
Fort Detrick, Maryland 21702-5012

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for Public Release; Distribution Unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

Purpose: Define transcription factors critical for SLE pathogenesis
Scope:

1) Expand chromatin marks to identify latent enhancers and regulatory regions relevant for SLE
2) Inhibit identified TF to define cellular effects

A key aspect was comparing different clinical subsets of SLE and using patients with rheumatoid arthritis as inflammatory controls

All libraries have been prepared but some analysis is ongoing.
ATF3 overexpression was performed with no clear alteration in gene expression.

15. SUBJECT TERMS

Lupus, epigenetics, transcription factors, chromatin

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON** USAMRDC
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**	Unclassified	**24**	**19b. TELEPHONE NUMBER** *(include area code)*
Unclassified	Unclassified	Unclassified			

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Introduction

Systemic lupus erythematosus (SLE) is a chronic inflammatory disease affecting predominantly young women during their peak productive years. Typical manifestations of SLE include a photosensitive rash, glomerulonephritis, arthritis, and serositis. In the USA, 1.5 million people are thought to be affected with annual direct care costs of $15,000 and annual lost productivity costs of $9,000 per patient. In addition, people with lupus can have compromised fertility and have a 30% rate of disability, demonstrating the profound impact of this disease. Mortality is thought to be about 2.5 fold higher than the general population with some demographic groups (children, women of color, those living in poverty) having a poorer prognosis. Premature vascular disease and depression represent significant chronic medical burdens.

Our data have demonstrated a clearly altered epigenome in SLE patients, with both a global increase in H4 acetylation and higher peaks of H4ac at critical interferon-response genes. The transcriptome was also shown by us to be broadly altered, with increased splicing, expression of novel loci, as well as the expected increased expression of some interferon-responsive genes. Our ChIP-seq studies of SLE monocytes demonstrated a limited set of TF motifs, which gives us confidence in this approach and supports extension to B cells and T cells. We have proposed that the **altered epigenome contributes both to disease phenotype and also to persistence of disease** by facilitating and perpetuating pathologic gene expression in immunologically competent cells.

Objective

Our ultimate objective is to cure SLE. Today it is considered a chronic disease with fairly established management options and the idea of cure is radical. Nevertheless, we foresee a time where the immune system can be re-set using epigenetic therapies. This proposal represents an early effort to innovate a new approach using rational targeting of the epigenome based on an unbiased analysis of transcription and epigenetic changes.

Specific Aims

Aim 1: We will expand the chromatin marks we previously examined to better identify latent enhancers. We will identify differences and commonalities among H3K4me3, H3K4me1, H3K27ac, and p300 patterns in CD4/CD45RO T cells, CD19 B cells, and CD14 monocytes from SLE patients. From the promoter and enhancer chromatin marks with differential peak height, we will derive a set of TFs via position weight matrix (PWM) analysis for further study. Therapeutic efforts must address the broad range of dysfunction seen in immunologically competent cells in SLE. The goal is to identify altered TF and signaling pathways common to all three cell types.

Aim 2: Inhibition of TFs using siRNA in cells from donors with SLE will be evaluated for effects on the epigenome. The ultimate goal of our focus on TFs is to find a druggable pathway common to all three cell types in SLE. This Aim will test that hypothesis directly.

Impact

SLE has not benefitted from the many therapeutic advances in targeting the immune system that have benefitted other patients in Rheumatology. A completely new approach is needed and we have robust data to support efforts directed at the epigenome.

Key words
Lupus, epigenetics, histone marks, chromatin

Accomplishments

Statement of work milestones

Task	Subtask	Subjects	Recruited	Libraries	Analysis
Aim 1A	ChIP-seq on SLE and controls	40 SLE (10 cutaneous, 10 nephritis) 20 RA 20 HC	80 subjects- completed	216 completed 24 subjects - pending	Limited analysis
	RNA-seq on SLE and controls	40 SLE (10 cutaneous, 10 nephritis) 20 RA 20 HC	80- completes	0	No analysis
	PWM matrix	40 SLE (10 cutaneous, 10 nephritis) 20 RA 20 controls	80- completed	N/A	No analysis
Aim 1B	ChIP assay confirmation	20 SLE 20 controls	40- completed	N/A	No analysis
	qRT-PCR	20 SLE 20 controls	4- completed	N/A	Completed
Aim 1C	Compare clinical subsets	10 Nephritis 10 Cutaneous	20- completes	60- completed	Limited analysis
Aim 2A	IRF1 and ATF3 ChIP-seq	10 SLE 10 controls	20- completed	20	Limited analysis
Aim 2B	IRF1 and ATF3 KD	10 SLE 10 controls	20- completed	N/A	ATF3- no phenotype, IRF1 complete
Aim 2C	Other TF	10 SLE 10 controls	20- completed	N/A	No analysis

Results and outcomes
Libraries are prepped and run. Some analysis completed but not all.

Training and professional development: Nothing to report.

Opportunities for training: The Research Associate working on library preparation has gained skills in epigenetics and improved her knowledge of chromatin dynamics.

Dissemination: Nothing to report

Plans for the next reporting period: Completion of analysis

Impact

Impact on principal disciplines: Nothing to report

Impact on the base of knowledge: Nothing to report

Impact on other disciplines: Nothing to report

Impact on technology transfer: Nothing to report

Impact on commercial technology: Nothing to report

Impact on society: Nothing to report

Changes/Problems

This has surely been a period of major challenges. The pandemic was a huge detriment to our Program. The delay had an effect on our budget because we had to pay the subcontract for longer than anticipated. We therefore have less funds for library preparation. Nevertheless, we are proceeding with analysis and completion of all aims.

Products

Publications: Nothing to report

Books or other non-periodicals: Nothing to report

Other publications: Nothing to report

Website: Nothing to report

Technologies or techniques: Nothing to report

Inventions, patens, licenses: Nothing to report

Other Products: Nothing to report.

Reportable outcomes: Nothing to report

Participants and other collaborating organizations

Name: Kathleen Sullivan
Role: PI
ORCID: 0000-0003-4018-1646
Nearest person months worked:
Contribution: Study design and execution
Other sources of funding: See following list

Name: Michelle Petri
Role: Co-investigator
ORCID: 0000-0003-1441-5373
Nearest person months worked:
Contribution: Recruitment and study design
Other sources of funding: See list

Has there been a change in the other support of the PI/key personnel? Yes. Please see listing below

Sullivan, KE Other support
Currently active and grants that have ended
Changes from beginning of DOD noted in Effort line

NIH (PI: Sullivan) 9/20/18-6/30/22 1.2 cm
5U01HG010219-02
Title: UDN Clinical Site
The UDN is a national network focused on the use of advanced technologies to diagnose patients with rare diseases. CHOP is one of the sites.
Effort: decreased from 2.4 to 1.2 calendar months.
No overlap in topic or studies

Department of Defense (PI: Sullivan) 9/15/19-9/14/22 0.6 cm
W81XWH-19-1-0562
Title: SLE Transcription Factor
We are studying the role of ATF3 and other transcription factors in the etiology of SLE. Using ChIP-seq for chromatin marks and transcription factors in various cells, we will define pathways related to disease.
Effort: Current project. Effort unchanged
No overlap in topic or studies

Primary Immune Deficiency Treatment Consortium (PI: Puck) 9/13/2019-8/31/2024 0.24 cm
5U54AI082973-12
Title: Primary Immune Deficiency Treatment Consortium
This support will be used to support patient advocacy group involvement in the PIDTC and to support development of PIDTC clinical research protocols.
Effort: No changes to effort
No overlap in topic or studies

National Institute of Diabetes and Digestive and Kidney Diseases (PI: Kelsen) 7/01/2021 – 7/01/26
0.6cm R01DK127044-01A1

Title: Integration of genomics and transcriptomics to investigate biological pathways in very early onset IBD
The major goal of this project is to integrate genomics and transcriptomics to characterize the underlying drivers of very early onset inflammatory bowel disease.
Effort: New project
No overlap in topic or studies. This grant studies IBD.

NIH (PI: Kathleen Sullivan) 6/12/18-5/31/21 1.2cm
5R21AI130967-02
Title: Persistant Rubella
Effort: Project ended. No salary support currently

NIH (PI: Sullivan) 4/1/2015 - 3/31/2020 1.2cm
5U24AI086037-10
Title: Resources to Assist Investigations in Primary Immunodeficiency Diseases
Effort: In NCE without salary currently

Lupus Foundation of America (PI: Kathleen Sullivan) 10/1/14- 12/30/20 1.8 cm
Title: HER2 in Lupus Nephritis
Effort: Project ended, no salary support

Alliance for Lupus Research 7/1/16-6/30/19 0.6 cm
BRISC DUB activity as a Novel Target for Lupus
Role: Co-Investigator
Effort: No effort, project ended

Michelle Petri Other support
Currently active and grants that have ended
Changes from beginning of DOD noted in Effort line

NIH (PI: Petri) 7/1/16-6/30/22 4.2cm
NIH number
Title: The Johns Hopkins Lupus Cohort
Effort: No change
Overlap: This cohort represents the base population for patient recruitment and the clinical data will be used in analyses. The effort does not overlap because the DOD grant effort supports data analysis of the project data.

NIH (PI: Petri) 9/4/14-5/31/22 1.2cm
NIH number
Title: Accelerating Medicines Partnership in RA and Lupus: Network Research Sites (UH2/UH3)
Effort: No change
Overlap: This study is focused on biomarkers of outcome in SLE. No overlap.

Astra Zeneca (PI: Petri) 12/1/17-10/31/22 0.24cm
Is there a number?
Systemic Lupus Erythematosus (SLE) Prospective Observational
Effort: no change
Overlap: This supports an observational study of interferon signature and QOL. No overlap.

APS Action (PI: Petri) 11/1/12-9/5/25 0.12cm
Is there a number?

Title: Antiphospholipid Syndrome Alliance for Clinical Trials and International Networking Database and Repository
Effort: No change in effort
Overlap: This supports development of a registry and database for APS. No overlap.

Exagen Diagnostics (PI: Petri) 12/1/16-2/14/26 0.12cm
Is there a number?
Title: Exagen: prospective analysis of complement on red blood cells
Effort: No change in effort
Overlap: This study supports measuring complement on red cells. No overlap.

Eli Lilly (PI: Petri) 9/15/12-12/31/22 0.12cm
Is there a number?
Title: Disease Progression, Treatment Patterns and Outcomes of a SLE US Cohort
Effort: No change in effort
Overlap: This study defines burden of disease in SLE. No overlap.

NIH (PI: Petri) 2/1/20-1/31/22 0.60cm
NIH number
Title: Autoimmunity to LINE-1-encoded antigens in SLE pathogenesis
Effort: This is a new project
Overlap: This study evaluates antibodies to LINE elements in SLE

Special reporting requirements

1. INTRODUCTION:

Systemic lupus erythematosus (SLE) is a chronic autoimmune disease affecting many organs and cell types. The disease places an enormous burden on the patients who are typically young women just beginning careers. Treatment remains unsatisfactory and is based on global immune suppression and patients have a chronic course with periodic flares and end organ damage accruing over time. **The foundation of this proposal is the observation that SLE patients have a widely altered epigenome that implicates a limited number of transcription factors, opening the door for targeted therapeutics.** We hypothesize that targeting the epigenome will allow the immune system to be re-set rather than just suppressed. This project will measure changes at promoters and enhancers in SLE, specifically focusing on transcription factors that alter chromatin.

2. KEYWORDS:

Lupus, SLE, epigenetics, histone, ATF3, Transcription

3. ACCOMPLISHMENTS:

- What were the major goals of the project?
    - H3K4me3, H3K4me1, H3K27ac, p300 ChIP-seq in SLE T cells, B cells and monocytes. The goal is to define implicated transcription factors.
        - 60 SLE patients (including 10 cutaneous disease and 10 with nephritis)
        - 20 patients with rheumatoid arthritis
        - 40 healthy donors
    - Inhibit identified transcription factors and measure effects on the epigenome using ChIP-seq
        - 30 SLE patients
        - 30 healthy donors
- What was accomplished under these goals?
    - We had just set up our recruiting infrastructure and assay systems when clinical research at both institutions was halted due to COVID-19. We have just begun receiving samples from Johns Hopkins again and have >20 samples on site. They have been prepared and are in the freezer but have not yet been run.
    - Johns Hopkins has a plan for an accelerated schedule for recruitment
    - CHOP has a plan for accelerated processing and running.
- What opportunities for training and professional development has the project provided?
    - Nothing to report
- How were the results disseminated to communities of interest?

- *Nothing to Report*

- **What do you plan to do during the next reporting period to accomplish the goals?**
  - *We have established an accelerated recruitment process so that we can "catch up" on our sample acquisition and complete all studies.*
  - *In the next 4 months, we will have run our test set of ChIP-seq assays (10 libraries each antibody) and analyzed for quality and have half of our samples recruited and stored.*

4. IMPACT:

- **What was the impact on the development of the principal discipline(s) of the project?**
  - *Nothing to Report*
- **What was the impact on other disciplines?**
  - *Nothing to Report*
- **What was the impact on technology transfer?**
  - *Nothing to Report*
- **What was the impact on society beyond science and technology?**
  - *Nothing to Report*

5. CHANGES/PROBLEMS:

- **Changes in approach and reasons for change**
  - *None*
- **Actual or anticipated problems or delays and actions or plans to resolve them**
  - *We believe that we will successfully execute all the studies in the statement of work. We are off to slow start due to delays in IRB approval and then COVID-19 but with our new recruitment plan in place, we should still complete all goals/tasks.*

- **Changes that had a significant impact on expenditures**
  - *CHOP had a hiring freeze and a key study member could not be hired until this month. This has not markedly impacted our progress since the effect of COVID-19 was greater than the effect of having to redistribute the work of the not-yet-hired person. Expenditures were overall delayed due to COVID-19.*
- **Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents**

- *No changes.*
- *CHOP IRB has stated this project is not human subjects experimentation since we receive de-identified samples.*
- *The Johns Hopkins IRB 00216558 was approved February 14, 2020*

- **Significant changes in use or care of human subjects**
  - None
- **Significant changes in use or care of vertebrate animals.**
  - N/A
- **Significant changes in use of biohazards and/or select agents**
  - None

6. PRODUCTS:

- **Publications, conference papers, and presentations**

  - **Journal publications.** .
  - *Nothing to Report*

  - **Books or other non-periodical, one-time publications.**

  - *Nothing to Report*
  - **Other publications, conference papers, and presentations.**
  - *Nothing to Report*

- **Website(s) or other Internet site(s)**
- *Nothing to Report*

- **Technologies or techniques**
  Nothing to Report
- **Inventions, patent applications, and/or licenses**
  Nothing to Report
- **Other Products**
  Nothing to Report

7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

- What individuals have worked on the project?
    - *Provide the following information for: (1) PDs/PIs; and (2) each person who has worked at least one person month per year on the project during the reporting period, regardless of the source of compensation (a person month equals approximately 160 hours of effort). If information is unchanged from a previous submission, provide the name only and indicate "no change."*

Name:	Kathleen Sullivan
Project Role:	*CHOP PI*
Researcher Identifier (e.g. ORCID ID):	*0000-0003-4018-1646*
Nearest person month worked:	1
Contribution to Project:	*Dr. Sullivan is the program PI and oversees design and execution of the overall project.*
Funding Support:	Lupus Foundation of America 10/1/14- 12/30/20 1.8 cm Title: HER2 in Lupus Nephritis NIH 6/12/18-5/31/21 1.2 cm 5R21AI130967-02 Title: Persistent Rubella NIH 9/20/18-6/30/22 1.2 cm 5U01HG010219-02 Title: UDN Clinical Site DOD 9/15/19-9/14/22 0.6 cm W81XWH-19-1-0562 Title: SLE Transcription Factor NephCure Foundation 1/1/20-12/31/20 .48 cm AWD-00000120 Title: Lymphocyte profile pre-rituximab in pediatric nephrotic syndrome CHOP 7/1/18-6/30/212.4 cm 28700RFRNT19002 Title: Frontier- Immune Dysregulation NIH 9/13/19-8/31/24 .36 cm 2U54AI1082973-11 Title: Primary Immune Deficiency Treatment Consortium
Name:	*Michelle Petri*
Project Role:	*Johns Hopkins site PI*
Researcher Identifier (e.g. ORCID ID):	*0000-0003-1441-5373*

Nearest person month worked:	*1*
Contribution to Project:	*Dr. Petri oversees the clinical data, patient recruitment and provides expertise on SLE.*
Funding Support:	NIH 7/1/2016 – 7/31/2021 4.0 cm R01 AR069572 Title: Hopkins Lupus Cohort NIH 3/8/2019 – 2/29/2024 0.8 cm R01 AR074096 Title: Monitoring Disease in Lupus NIH 9/1/2018 – 8/31/2023 0.2 cm 5R01AR073850 Title: Characterization of the lupus nephritis microRNAome - UAB PROFILE IV NIH 9/24/2014 – 5/31/2021 3.2 cm UH2AR067679 Title: Accelerating Medicines Partnership (AMP) in Rheumatoid Arthritis and Lupus: Network Research Sites DOD 9/1/2019 - 8/31/2020 0.7 cm W81XWH-19-1-0793 Title: A spatial temporal analysis of organ-specific lupus flares in relation to atmospheric and environmental factors Institutional funds pay the remainder
Name:	*Li Song*
Project Role:	*Technician*
Researcher Identifier (e.g. ORCID ID):	*None*
Nearest person month worked:	*4*
Contribution to Project:	*Ms. Song processes all the ChIP-seq samples*
Funding Support:	NIH 6/12/18-5/31/21 6.0 cm 5R21AI130967-02 Title: Persistent Rubella DOD 9/15/19-9/14/22 3.2 cm W81XWH-19-1-0562 Title: SLE Transcription Factor Institutional funds pay the remainder
Name:	*Amrita Raj*
Project Role:	*Research Coordinator*

Researcher Identifier (e.g. ORCID ID):	*None*
Nearest person month worked:	*4*
Contribution to Project:	*Patient recruitment and clinical database*
Funding Support:	NIH 7/1/2016 – 7/31/2021 3.0 cm R01 AR069572 Title: Hopkins Lupus Cohort NIH 3/8/2019 – 2/29/2024 1.0 cm R01 AR074096 Title: Monitoring Disease in Lupus NIH 9/1/2018 – 8/31/2023 3.0 cm 5R01AR073850 Title: Characterization of the lupus nephritis microRNAome - UAB PROFILE IV Institutional funds pay the remainder - 2.0 cm

-
-
- **Has there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?**
    - Sullivan
        - Addition of this grant.
        - Reduction in effort on U01HG010219 from 2.4 calendar months to 1.2
        - Removal of effort on U24AI086037 due to project ending
        - Removal of effort on Lupus Foundation Award due to project ending
        - Removal of effort on 543769 – ALR due to project ending
        - Increase in effort on U54082973 from 0.24 calendar months to 0.36 calendar months
- **What other organizations were involved as partners?**
    - **Organization Name:** Johns Hopkins University School of Medicine
    - **Location of Organization:** *Baltimore, MD*
    - **Partner's contribution to the project** *(identify one or more)*
        - **Financial support;**
        - **In-kind support**
        - **Facilities** *X*

- Collaboration *X*
- Personnel exchanges
- Other

8. SPECIAL REPORTING REQUIREMENTS
    - COLLABORATIVE AWARDS:
    - QUAD CHARTS: *See attached*
9. APPENDICES: *N/A*

Transcription Factor Analysis of SLE

LR180127

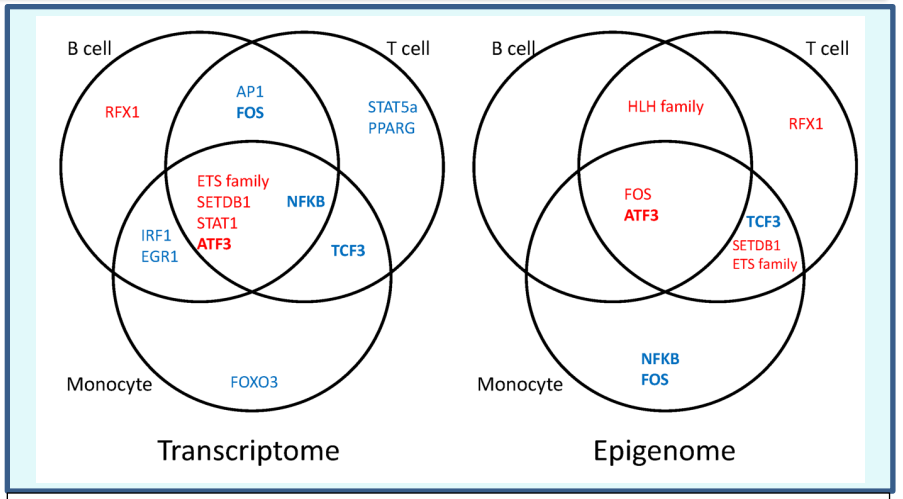
PI: Kathleen Sullivan **Org:** Children's Hospital of Philadelphia **Award Amount:** $524,610

Study/Product Aim(s)

- Examine chromatin marks in T cells, B cells and monocytes in SLE
- Identify putative transcription factors related to altered chromatin
- Test the role of the transcription factors in RNA expression

Approach

We will identify differences and commonalities among H3K4me3, H3K4me1, H3K27ac, and p300 patterns in CD4/CD45RO T cells, CD19 B cells, and CD14 monocytes from SLE patients. From the promoter and enhancer chromatin marks with differential peak height, we will derive a set of TFs via position weight matrix (PWM) analysis for further study. Inhibition of TFs using siRNA in cells from donors with SLE will be evaluated for effects on the epigenome.



This forms the basis of our approach. To date, we have completed patient recruitment and have prepped most of the libraries.

Timeline and Cost

Activities CY	19	20	21	22
Patient recruitment				
ChIP-seq for chromatin				
ChIP-seq for transcription factors				
TF inhibition/overexpression				
Estimated Budget ($K)	**$000**	**$000**	**$000**	**$000**

Updated: September 26, 2022

Goals/Milestones

CY20 Goal – Patient recruitment
Pipeline established, IRB in place
CY20 Goal – Begin ChIP-seq for transcription factors
Immunoprecipitation done, testing completed
Libraries prepared and run
CY21 Goal – Transcription factor testing
Over-expression and under-expression in vitro
ChIP-seq libraries run
CY22 Goal - Complete ChIP-seq libraries

Comments/Challenges/Issues/Concerns

- start was delayed due to COVID
- Libraries all run but not yet fully analyzed

Budget Expenditure to Date

Projected Expenditure: 524,610
Actual Expenditure: 524,610

Other Support

SULLIVAN,
K.E.

ACTIVE

NIH (PI: Sullivan) 9/20/18-6/30/22 1.2 cm
5U01HG010219-02
Title: UDN Clinical Site
The UDN is a national network focused on the use of advanced technologies to diagnose pateints with rare diseases. CHOP is one of the sites.
Effort has decreased from 2.4 to 1.2 calendar months.
No overlap in topic or studies

Department of Defense (PI: Sullivan) 9/15/19-9/14/22 0.6 cm
W81XWH-19-1-0562
Title: SLE Transcription Factor
We are studying the role of ATF3 and other transcription factors in the etiology of SLE. Using ChIP-seq for chromatin marks and transcription factors in various cells, we will define pathways related to disease.
New project
No overlap in topic or studies

Primary Immune Deficiency Treatment Consortium (PI: Puck) 9/13/2019-8/31/2024 0.36 cm
5U54AI082973-12
Title: Primary Immune Deficiency Treatment Consortium
This support will be used to support patient advocacy group involvement in the PIDTC and to support development of PIDTC clinical research protocols.
Effort has increased from 0.24 cm to 0.36 cm
No overlap in topic or studies

National Institute of Diabetes and Digestive and Kidney Diseases (PI: Kelsen) 7/01/2021 – 7/01/26 0.6cm
R01DK127044-01A1
Title: Integration of genomics and transcriptomics to investigate biological pathways in very early onset IBD
The major goal of this project is to integrate genomics and transcriptomics to characterize the underlying drivers of very early onset inflammatory bowel disease.
New project
No overlap in topic or studies.

PENDING

NIH (PI: Sullivan) 4/1/21-3/31/26 1.2 cm
1R24AI155390-01
Title: United States Immune Deficiency Network: A resource for clinical immunologists
This proposal would fund a registry and various informatic efforts to support optimal care of pateints with primary immunodeficiencies.
No overlap in topic or studies

NIH (PI: Sullivan) 7/1/21-6/30/26 1.2cm
1R01AI162777-01
Title: Mechanisms of autoimmunity in 22q
This is focused on autoimmune cytopenias and biomarkers.
There is no overlap in topic or studies

NIH/NIGMS (PI: Hakonarson) 4/1/2022-3/31/2027 3.0 cm
1RM1GM145418-01
Title: Integration of Multi-Omics Technologies and iPSC Models in Sepsis Patients to Profile Gene Expression, Transcripts, Proteins, and Metabolites in Derived Tissues for Precision Based Therapies
This Program will utilize a multi-omics approach to understand the trajectory of changes in sepsis related to metabolism, immune function, and host genetics.
There is no overlap in topic or focus

NIH/NIAID (PI: Sullivan) 4/1/2022-3/31/2027 1.2 cm
1R24AI155390-01A1
USIDNET: A resource for clinical immunologists
To establish a patient registry and a portfolio of genetic resources for clinical immunologists
There is no overlap in topic or studies

COMPLETED GRANTS

NIH (PI: Kathleen Sullivan) 6/12/18-5/31/21
5R21AI130967-02
Title: Persistant Rubella
This project is dedicated to identifying immune responses to rubella and determing if there is persistence of virus in select populations.

NIH (PI: Sullivan) 4/1/2015 - 3/31/2020
5U24AI086037-10
Title: Resources to Assist Investigations in Primary Immunodeficiency Diseases

Alliance for Lupus Research (PI: Sullivan) 5/1/2017 - 4/30/2019
543769
Title: DUB Lupus