UTeach

Natural Sciences
The University of Texas at Austin

**UT
MATHEMATICS
DEPARTMENT**

**The UTeach Program Natural Sciences and
the UTeach Summer Masters Program**

What is UTeach Natural Sciences?

A Secondary Math and Science Teacher Preparation Program at The University of Texas, Austin

The **UT**each Undergraduate Secondary Certification Program in Natural Sciences

A Partnership between

- **UT Colleges of Natural Sciences**
- **and Education and**
- **Central Texas School Districts**

UTeach attacks the problem

- **Quantity:**
  - **UTeach** attracts top CNS students who would not otherwise have considered teaching

- **Quality:**
  - **UTeach** prepares these students at high levels of excellence in their academic discipline as well as in teaching techniques

- **Retention:**
  - **UTeach** provides support network to help graduates in early years of teaching

**UTeach** is a **four-year** undergraduate academic program with:

- **Rigorous preparation in mathematics** and science

  [Including mathematics courses designed to fit the special needs of future mathematics teachers]

- Early and on-going field experiences in public schools
  - Emphasis on inner city schools
  - Supervision by excellent mentor teachers

- New pedagogy courses, focused on teaching science & math, developed by both colleges, taught by UT professors and outstanding secondary school teachers

- Inquiry-based learning/teaching

- Research experience

UTeach Enrollment at
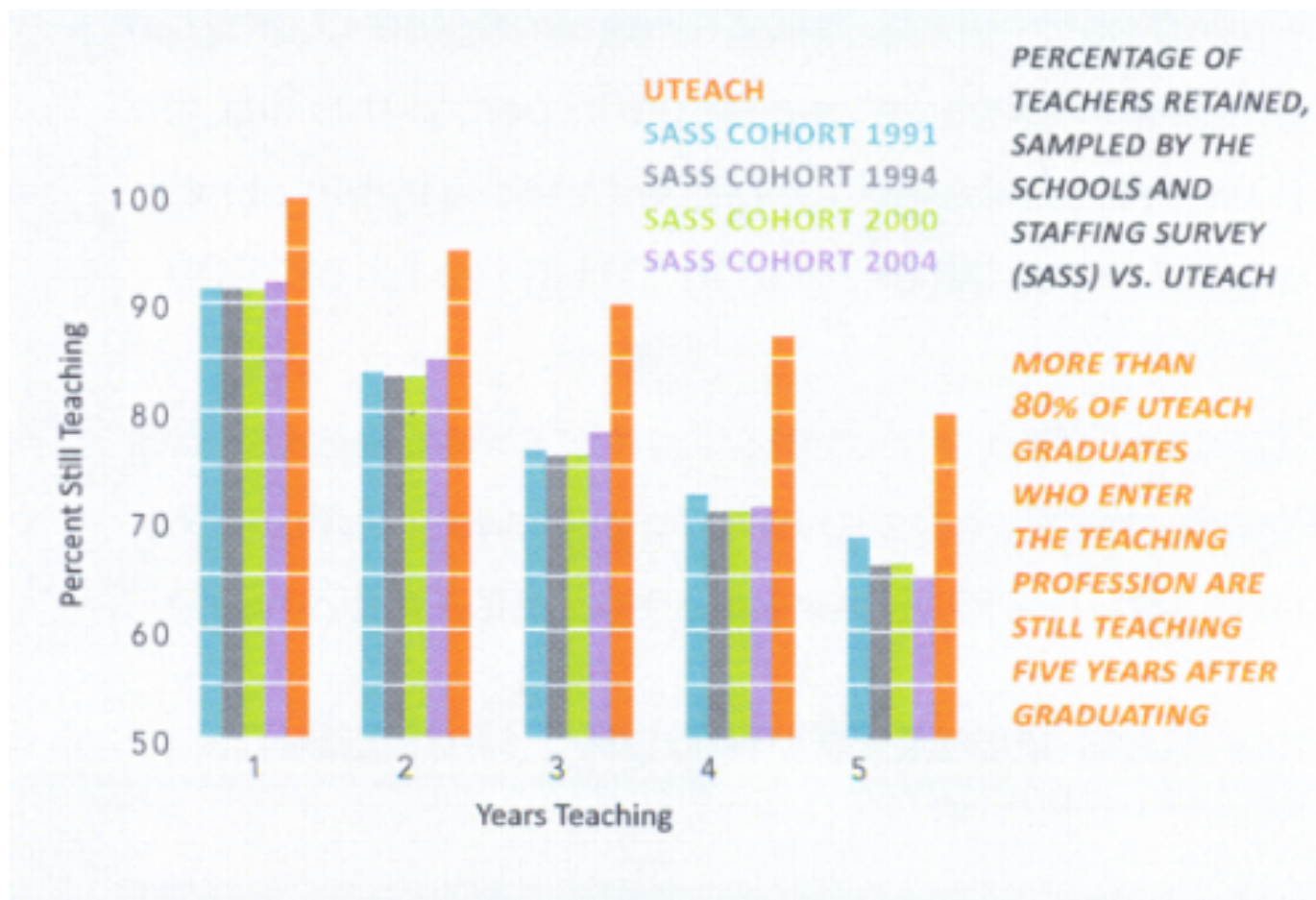# The University of Texas at Austin
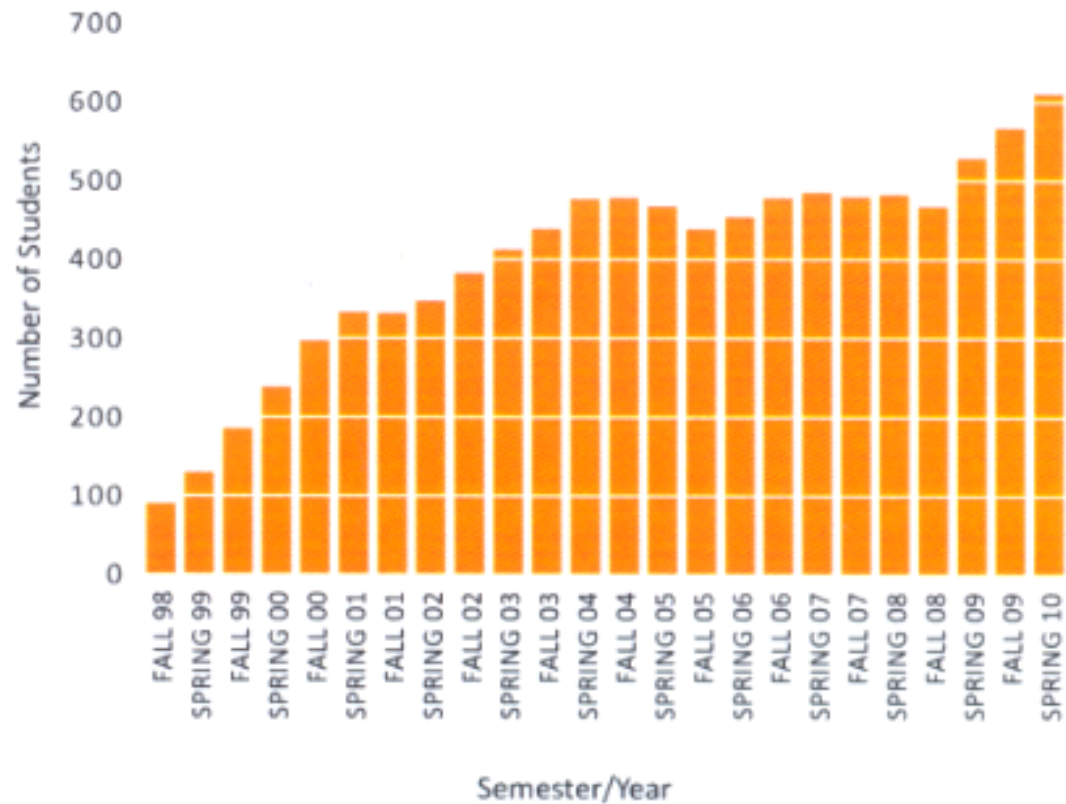
UTeach Graduates

Math and Science Teachers from UT Austin
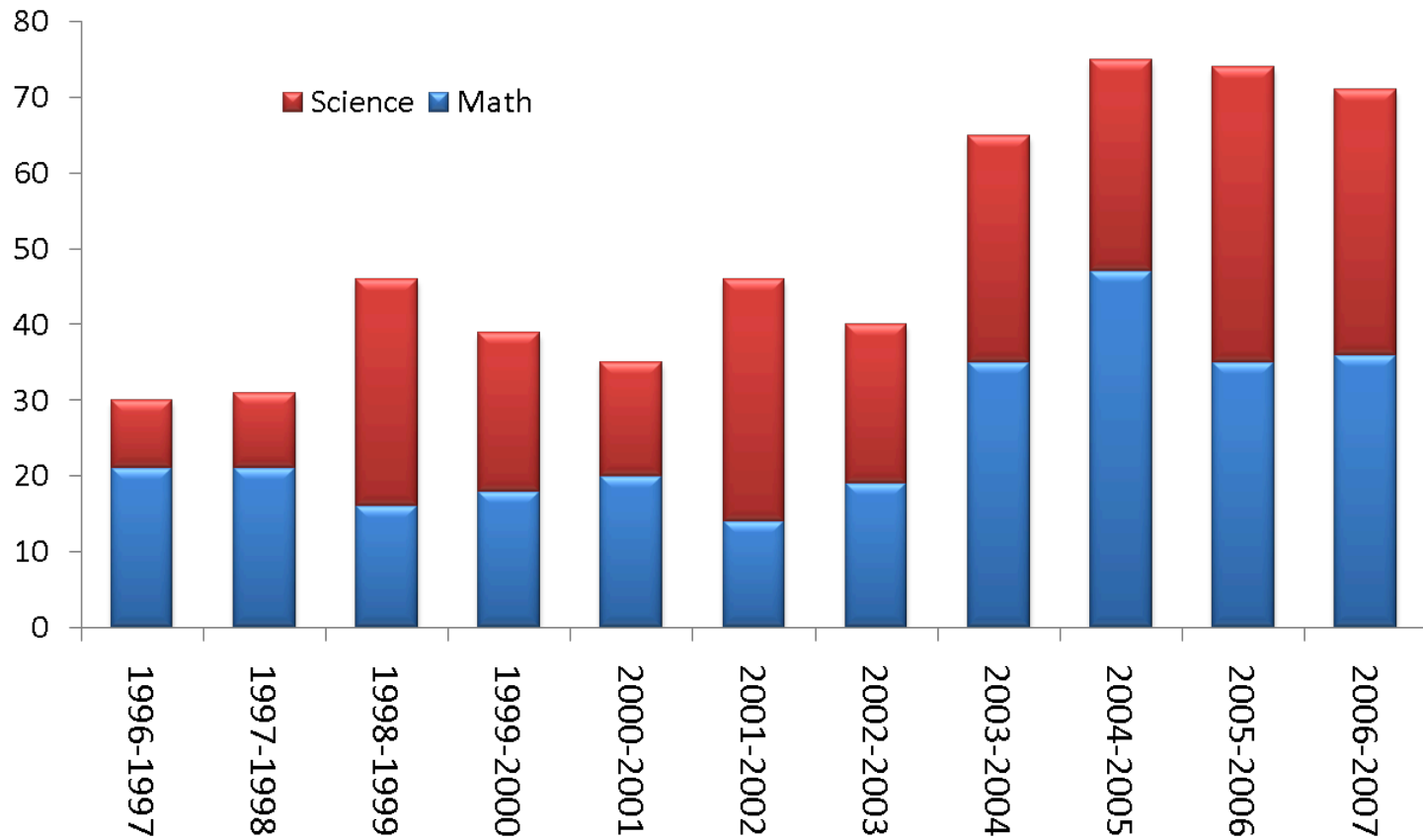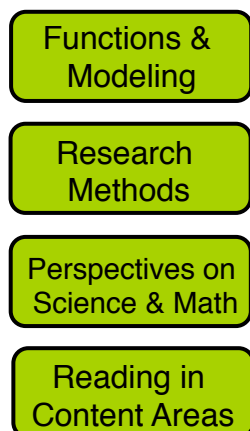
Retention of UTeach Graduates

UTeach Curriculum Overview

UTeach Course Sequence – in addition to the requirements of the mathematics or science major

specially designed content courses

Functions & Modeling

Research Methods

Perspectives on Science & Math

Reading in Content Areas

recruitment courses

Step 1	Step 2

College of education sequence

Knowing & Learning	Classroom Interactions	Project-Based Instruction

Apprentice Teaching
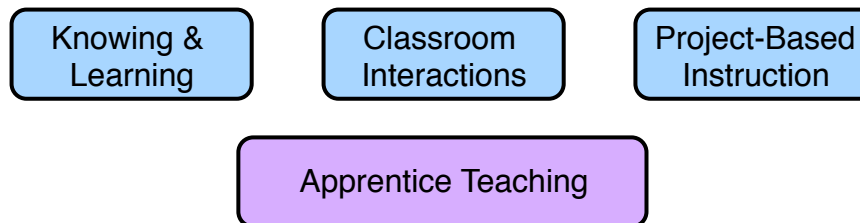
Total Course Hours: 24 – 30

Professional Development Course Hours: 18

Field Experience Hours: approx 325 (48 before AT)

Degree Plan for Mathematics Certification along with B.S. Mathematics

1. Mathematics 408C and 408D, or 408N and 408S, .
2. Mathematics 315C.
3. At least thirty-two semester hours of upper-division coursework in mathematics, consisting of
a.Mathematics 341.
b.Mathematics 325K, 328K, 333L, 358K, and 362K.
c.Mathematics 360M, or 375T (Topic: *Discovery: Introduction to Advanced Study in Mathematics*). Students seeking middle grades mathematics certification must complete Mathematics 326K.
d.Mathematics 361K or 365C.
e.Mathematics 343K, or 373K.
f.Mathematics 427K or 378K.
g.Enough of the following coursework to provide a total of at least thirty-two semester hours: Mathematics 326K, 427K, 328K, 339J, 339U, 343K, 343L, 348, 360M, 361, 365C, 365D, 368K, 373K, 373L, 175T (Topic: *Seminar for Prospective Teachers*), 378K.
h.A three-semester-hour supporting course that uses mathematics but is in a field other than mathematics.

UNDERGRADUATE COURSES DESIGNED FOR UTEACH MATHEMATICS MAJORS OR WITH UTEACH MAJORS IN MIND:

- **M315C Functions and Modeling**
- **M333L Structure of Modern Geometry**
- **M358K Applied Statistics**
- **M360M Mathematics Problem Solving**
- **M361K Intro to Analysis**
- **M375D Discovery – An Introduction to Advanced Studies in Mathematics**

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Master of Arts Mathematics (Proposed MAT) Summer UTeach Option

And

UTeach Summer Master of Arts in Science or Mathematics Education

The **UT**each Summer Masters Program

- **3 summers - face - to - face for 9 weeks**
  - **13 days per 3 hour credit**

- **2 intervening years - on-line courses**
  - **Focused on Research Methods, Statistical analysis of data and Lesson Study**

- **Final summer research experience**
  - **In Mathematics or Mathematics Education**

- **Three Masters Degree options for mathematics cohorts**

The **UT**each Summer Masters Program:
The Challenge!

- **How to continue to meet teacher's needs AND allow them to earn a master's degree?**

- **How to make this work for full time teachers across the state?**

- **How to make it financially feasible?**

- **How to design new mathematics courses at the graduate level that support secondary curriculum?**

Masters Degree Options –mathematics cohorts

- Master of Arts in Science and Mathematics Education

  1. Standard STEM Ed. with 9 hours of mathematics and a Report.

  2. STEM Ed. Degree w/ 18 hours of mathematics and no Report.

- Master of Arts in Mathematics (Recently proposed as a MAT Mathematics Degree Option)
  - 18 hours of structured classes in mathematics
  - 6 hours of structured education classes
  - Online coursework
  - Research in support of Report
  - Masters report

MASTERS MATHEMATICS EDUCATION

DEGREE PLAN

1st Summer	1st Academic Year	2nd Summer	2nd Academic Year	3rd Summer
EDC 385G: Knowing and Learning in Science and Math (3 hrs.)	EDC 196T or UTS 180: Directed Research in Curriculum and Instruction (1 hr/sem. in Fall & Spring)	EDC 384P: Equity and Policy in Mathematics, Science, and Technology Education (3 hrs.)	EDC 196T or UTS 180: Directed Research in Curriculum and Instruction (1 hr/sem. in Fall & Spring)	Supervised research in mathematics (6 hrs. Discipline or SME credit based on Supervisors)
EDC 385G: Curriculum and Instruction (3 hrs.)		Disciplinary Course #2 M 396C: Geometry and Topology (3 hrs.)	Research Preparation (1 hr/semester in Fall and Spring - Discipline or SME credit based on Supervisors)	SME 398R: Master's Report (3 hrs.)
Disciplinary Course #1 M 396C: Analysis (3 hrs.)		Disciplinary Course #3 M 396C: Applications of Calculus (3 hrs.)		

SUMMER MA MATHEMATICS DEGREE PLAN
(proposed MAT Option)

1st Summer	1st Academic Year	2nd Summer	2nd Academic Year	3rd Summer
EDC 385G: Knowing and Learning in Science and Math (3 hrs.)	UTS 180: Directed Research in Curriculum and Instruction (1 hr/sem. in Fall & Spring)	Disciplinary Course #2 M 396C: Applied Statistics (3 hrs.)	UTS 180: Directed Research in Curriculum and Instruction (1 hr/sem. in Fall & Spring)	Disciplinary Courses #5 M396C: Topics in Number Theory (3 hrs.)
EDC 385G: Curriculum and Instruction (3 hrs.)		Disciplinary Course #3 M 396C: Geometry and Topology (3 hrs.)	Research Preparation (1 hr/semester in Fall and Spring – 2 hrs total Disciplinary Courses A & B)	Disciplinary Courses #6 M396C: Discrete Deterministic Chaos (3 hrs.)
Disciplinary Course #1 M 396C: Analysis (3 hrs.)		Disciplinary Course #4 M 396C: Cryptography (3 hrs.)		M 398R: Master's Report: based on an original or previous coursework (3 hrs.)

Summer Mathematics Masters Enrollment

Cohort	2004	2005	2006	2007	2008	2009	2010	2011	Total number of Teachers
Mathematics MA	N/A	N/A	11	10	12	11	8	0*	52
MathEd MA	11	14	0	2	3	3	1	7	41

Mathematics Course Descriptions for the Summer Masters Program

First a list of the Masters Mathematics Courses:

- Analysis on the Real Line
- Applied Calculus (to be replaced w/ Cryptography)
- Topology and Knot Theory
- Applications of Statistics (Bayesian) (also to be updated)
- Discrete Mathematics
- Discrete Deterministic Chaos

ŋ M396C: Analysis on the Real Line

The course builds upon properties of the real number system in relation to fundamentals of calculus. Foundations of the exponential function, as well as other transcendental functions, will be developed in the context of the real number system. Properties of uniqueness and existence will be investigated in relation to differential equations. The concept of infinite sequences and series will be explored in terms of use and approximation methods. Differential equations in modeling real world application will be a topic. The idea of "integrability" in relation to concepts of calculus will also be developed. The course is project-based with special emphasis placed upon mathematical content covered in relation to secondary mathematics curriculum.

ŋ M396C: Topology and Knot Theory

This 'Topics' course is based in Topology and Geometry. Explorations in the course are devoted to applications of knot theory (a branch of topology) and geometry in order to understand the actions of enzymes called "topoisomerases" on DNA. Attention is also focused upon developing the geometry for a computer simulation of a strand of DNA. The course is project-based with special emphasis placed upon mathematical content covered in relation to secondary mathematics curriculum.

M396C: Applications in Calculus

The theme of the course in Applied Calculus is to explore applications of calculus in the physical world with an emphasis on the proper language of mathematics. The basic goal of the course is to illustrate that mathematics is not about numbers, but is actually about information dealt with in an abstract manner using a highly precise technical language. Specifically, basic concepts in calculus will be reviewed, stressing their applicability to real life. The course is project-based with special emphasis placed upon mathematical content covered in relation to secondary mathematics curriculum.

M396C: Applied Statistics (Bayesian)

The title of this course is "Math Applied to the Environment, Health, and other things that matter." Topics from Statistics, Probability, and Risk Analysis will be covered along with an introduction to Bayesian statistical methods. Some of the material of the course will be based on articles from Chance Magazine, Scientific American, the College Mathematics Journal, The Mathematics Teacher, etc. The course is project-based with special emphasis placed upon mathematical content covered in relation to secondary mathematics curriculum.

M396C: Discrete Mathematics

The goal of the course is for students to discover some of the fundamentals of Discrete mathematics, constructing much of the essential theory largely on their own, with some minimal facilitation by the instructor employing an inquiry-based method of instruction.

M396C: Discrete Deterministic Chaos

This course is designed to introduce students to modern topics in *discrete dynamical systems*. Basic mathematical ideas and theory behind the topics of the dynamics of the Quadratic Map, chaos, fractals, iteration, graphical analysis, complex functions, and the Julia and Mandelbrot Sets will be covered. Some use of technology in the form of exploratory mathematical computer software and graphing calculators will used in the course.

Online Coursework - An Example Assignment:

Read through CHAPTERS 2 & 3 of:
Yet Another Introduction to Analysis by V. Bryant (1990)

n Work through some of the examples or exercises of the chapter with the thought of whether any of the topics presented in the chapter OR THE RELATED FOUNDATIONAL MATHEMATICS associated with the chapter topics would be of interest to you to incorporate into a lesson study topic for your grade level instruction.

n Post to the discussion board a discussion of any of the topics or examples or exercises of the chapter that either interested you or that you think you might develop a lesson around at your grade level.

Online Coursework - An Example Research Assignment

> **Assignment 2: (which has 3 parts with 3 due dates)**
>
> You are to browse the various MAA journals: *The American Mathematical Monthly, The College Mathematics Journal, Focus, or the Mathematics Magazine* (using the UT library database, the actual journals, or the mathematics library in RLM) with the goal of finding articles pertaining to Topology, Number Theory, or Analysis (Advanced Calculus) that contain topics that could be used to strengthen the content knowledge of secondary mathematics teachers. You are to write a 2-3 page abstract of each of the articles that you select to research. The criteria for the abstracts are included as a separate document attached to this email. These abstracts will include a paragraph on the article's content connection to secondary mathematics supported by NCTM Standards.

A Sample of Previous Master Report Titles

- **Deal or No Deal: A Mathematical Approach, August 2006**

- **An Investigation of Optimization and an Introduction into Language Multipliers, August 2006**

- **Calculus Reform: At the University/College Level by Cynthia M. Sloan, August 2006**

- **Cryptology Decrypted: A Review of the Enigma and the RSA Cryptosystems, August 2006**

- **Applications of the Central Limit Theorem in Inventory Management, August 2006**

- **Solvability of Polynomials, August 2008**

- **The Diffie-Hellman Key Exchange and Prime Number Factorization, August 2010**

- **The Distribution and Theory of Prime Numbers, August 2007**

- **CAPTCHAS and Wave Filters 2009**

Career Advancement attributed to the Master's Program by some of our Graduates:

- "I started working as an adjunct at Northwest Vista Junior College teaching college level math. I do feel it is a promotion but not in the traditional sense, I look at it more that the Masters degree opened more doors for me."

- "Obtaining my Masters degree with The University of Texas UTeach program has enabled me to take on a leadership role by becoming a Site Coordinator with the UTeach Institute…This new position was certainly a direct result of obtaining this Masters degree."

- "I am working, part time, as an induction Coordinator for the UTeach Program at the university of Texas at Austin."

- "This year I have taken on AP Statistics, a class I hadn't previously taught… I feel that going through the UTeach program gave me more experience with Statistics than I previously had and made me feel more comfortable with the material and thus more comfortable committing to being the 'new Statistics teacher'."

- "The change in my role at school has been my selection this year as Teacher of the Year at Bowie High School… My graduate studies really opened my eyes to how high school mathematics connects with college mathematics, and I have invested effort this year in emphasizing those connections."

- "I am currently the Algebra 1 lead for our math department and I do believe that this is because of my masters from UT. I am also the UIL Academics Coordinator and Math coach for my school."

n "I am now the mathematics site curriculum coordinator for my high school in Round Rock."

n "I have won the prestigious Milken Family Foundation National Educators Award ($25,000)."

Contact Information

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