

GRAD SCHOOL WORKSHOP

Overview

Part 1.

- What is graduate school and how does it work?
 - *Mathematics and Statistics/Biostatistics*

Part 2.

- How to apply?
- How to choose a school?

Part 3

- Questions/discussion.

Some quick facts

- It's usually "free" for PhDs (Tuition is waived, but you work.)
- It usually takes 5 or 6 years.
- For the most part, people don't get a master's degree first.
- Bachelors' degrees in 2020:
 - 26,146 BS in Math
 - 4,991 BS in Statistics and Biostatistics
 - 88,633 BS in CS & IS.
 - More than 2,012,854 overall.
- Ph.D.'s in 2020
 - 2,031 in Math
 - 736 in Statistics and Biostatistics (4,902 MS)
 - 2,361 in CS & IS
 - 55,283 overall

IES : NCES National Center for
Education Statistics

ASA AMERICAN STATISTICAL ASSOCIATION
Promoting the Practice and Profession of Statistics®



Survey of Earned Doctorates

A snapshot of math/stats grad school—year one

- During the first year
 - Basic coursework:
 - Math: algebra, topology, real & complex analysis, logic, applied math, perhaps others (depends on the school).
 - Stats: measure theory, probability, statistical inference (x2), applied statistics (x2)
 - Light teaching duties, like grading, leading recitations* in calculus or intro stats.
- End-of-year qualifying exams
 - Usually 2 or 3 exams
 - Math: [algebra](#), [topology](#), [analysis](#), applied math, logic.
 - Stats: [probability](#), [mathematical statistics](#), [applied statistics](#).
 - Usually 2 or 3 chances, sometimes different levels of passing.
 - The tests are **hard** but exhilarating. 😊



*A recitation is a guided problem session. Many schools have recitations associated with lower-division courses. Graduate students typically run them.

A MAP OF THE CAMPUS...

A snapshot of grad school—years 2&3

- During the year
 - More advanced coursework, specialization.
 - Research seminars (attending & speaking).
 - Teaching.
- Specialty exam
 - Oral exam in your area of specialization.
 - Usually given by your advisor and a committee of 3-4 other faculty.
 - Once passed, your status changes from “pre-candidacy” to “candidacy.”

A GRAD STUDENT'S MAP OF THE CAMPUS...



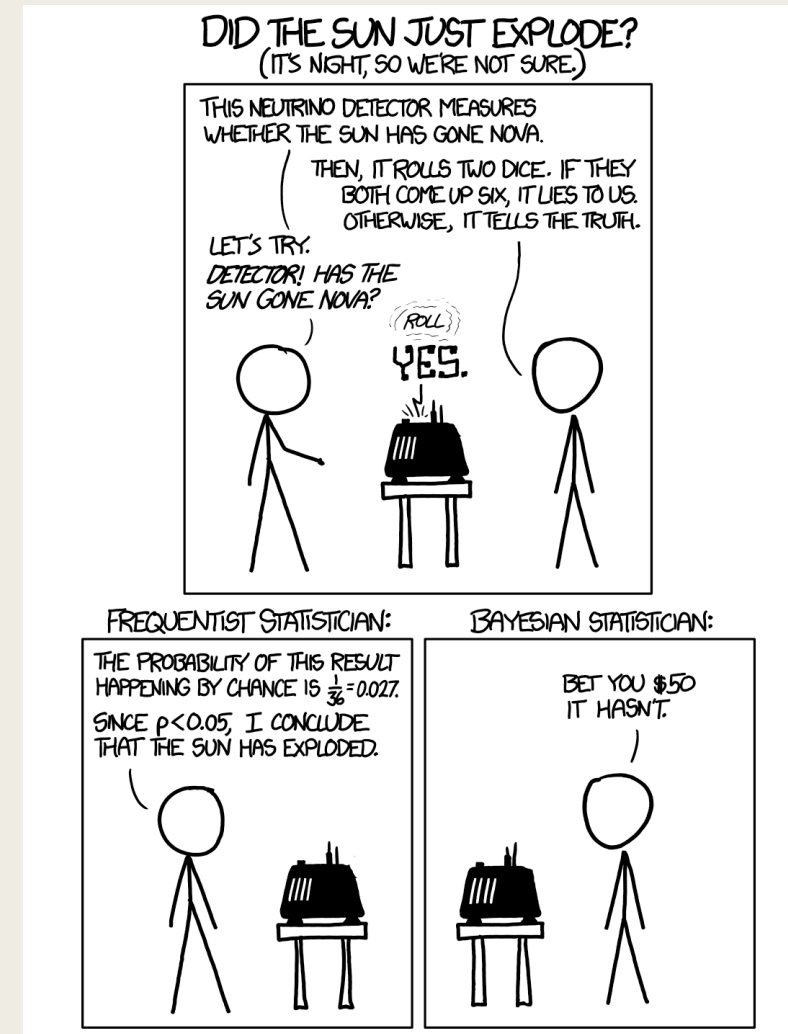
A snapshot of grad school— years 4 to 6



- During the year
 - Research and research seminars—no more regular coursework.
 - Traveling to and speaking at conferences.
 - Writing dissertation (thesis).
 - Teaching.
- Defense
 - Present your work.
 - Answer questions.
 - Transition from Ph.D. Candidate to Doctor of Philosophy in Mathematics, Statistics, or Biostatistics!!
- Apply for a job. (A topic for a different workshop.)

What about (bio)stats Master programs?

- Common path for desire to work in industry or government.
- A Ph.D indicates you know how to conduct research! Can still obtain industry job.
- Programs typically cost money, but do not require teaching or research .
- Generally, 2 years
- Coursework is more focused on computational and application areas. Graduates have vast knowledge of methods, their use, and analytical software like R and SAS. Some expertise in mathematical foundations (mathematical statistics, probability, etc.).
- Lots of job opportunities – can sometimes fill data science positions (generally as data analyst).



What about (bio)stats Master programs?



Applied Research Mathematician/ Mathematical Statistician

National Security Agency ★★★★★ 268 reviews

Fort Meade, MD

\$74,682 - \$116,788 a year - Full-time

You must create an Indeed account before continuing to the company website to apply

Apply on company site



Job Summary

Mathematicians and Mathematical Statisticians contribute across our mission by bringing both subject matter expertise and creative, critical thinking. A wide range of technical expertise finds a natural fit at NSA including, but not limited to, fields of algebra, combinatorics, Fourier analysis, operations research, graph analytics, regression, machine learning, exploratory data analysis, stochastic processes, statistical modeling, forecasting, and cryptography. To solve the problems generated by NSA's mission, mathematicians draw from a wide body of mathematical knowledge, including number theory, abstract algebra, graph theory, combinatorics, analysis, probability, statistics and more. Mathematics and statistics are core disciplines present in every aspect of our mission: to protect our Nation. The mission requires a strong offense and a steadfast defense. The offense collects, processes, and disseminates intelligence information derived from foreign signals for intelligence and counterintelligence purposes. The defense prevents adversaries from gaining access to sensitive classified national security information.

Qualifications

The qualifications listed are the minimum acceptable to be considered for the position. Salary offers are based on candidates' education level and years of experience relevant to the position and also take into account information provided by the hiring manager/organization regarding the work level for the position. Degree in Mathematics, Physics, Engineering, or Computer Science is preferred. Degree must include 2 years (which equates to approximately 24 credit hours) of advanced mathematics. Relevant experience must be in the design, development, use, and evaluation of mathematics models, methods, and/or techniques (e.g., algorithm development) to study issues and solve problems. Entry/Developmental (Grade: 7-9) Entry is with a Bachelor's degree and no experience. Full Performance (Grade: 11-12) Entry is with a Bachelor's degree plus 3 years of relevant experience or a Master's degree plus 1 year of relevant experience, or a Doctoral degree and no experience.

Staff Biostatistician (Multiple Openings)

St. Jude Children's Research Hospital ★★★★★ 366 reviews

Memphis, TN 38105

You must create an Indeed account before continuing to the company website to apply

Apply on company site



Overview

St. Jude Children's Research Hospital is seeking motivated biostatistics professionals to join our team, and further our life-saving mission. We have multiple positions available within the Department of Biostatistics. Successful candidates will be hired into the career level for which they qualify, based on their education and experience.

The Biostatisticians at St. Jude will have a direct impact on the mission of St. Jude by providing statistical expertise to researchers conducting clinical and experimental studies. The Department of Biostatistics is a large department with 14 faculty, 26 biostatisticians, 3 postdoctoral fellows, 8 computing professionals, and administrative staff. Biostatisticians work in teams with a faculty member and sometimes with other biostatisticians to support assigned specific research areas. This approach enables them to gain disease-specific knowledge and expertise while also building productive relationships with collaborators across St. Jude.

Biostatistician (multiple openings available)

We are seeking candidates with general biostatistics backgrounds who will enthusiastically advance the research and mission of St. Jude.

Our **biostatisticians** are responsible for:

- Assisting in analyses of research studies by using appropriate statistical methods and/or mathematical techniques
- Meeting with clinicians, scientists and other research personnel to discuss research projects, goals and hypotheses
- Providing support for statistical analyses by extracting data and ensuring accurate data files
- Using statistical software packages (e.g., SAS and/or R) to write computer programs to analyze data
- Preparing memoranda to effectively document data issues, statistical methodology, and analysis results and interpretations, including results in tabular and graphical forms
- Assisting investigators with abstract and manuscript development to disseminate research results

Duties are performed under the guidance of a faculty member.

Ideal knowledge, skills and abilities for **biostatisticians**:

- Knowledge of statistical methods
- Knowledge of statistical software such as SAS and/or R
- Strong oral and verbal communication skills, including the ability to effectively communicate statistical methodology and results to non-statisticians
- Excellent organizational and time management skills
- Ability to manage multiple projects with competing deadlines in a professional manner

About masters' programs, more generally...

Even if you think you only want a master's degree, apply for a PhD program.

Why? Well...

- It is waaaaayyy harder to change from an MS to a PhD program than the other way .
- Changing from a PhD to an MS only requires saying, "Okay, I've had enough. Ciao!"
- PhD programs are usually "free", masters' programs are usually not.
- If you start an MS (& pay), and switch to PhD, you have demonstrated that you can afford tuition, and probably won't get a TA position.

Applying to grad school: The big picture

1. Transcript.
2. C.V.
3. Personal statement.
4. Recommendation letters.
5. Test scores (sometimes).

Applying to grad school:

The (typical) review process

1. You submit your application, and your letter writers submit their letters.
2. The Graduate Selection Committee distributes the applications so that each application is reviewed by one or two members of the committee.
3. Each committee member picks their favorite few applications and presents them to the rest of the committee.
4. The committee ranks the applications and makes offers to the top several applicants.
5. If offers are turned down, they move down the list.

**As you put together your application, keep the process in mind.
*Make it easy for someone to advocate for you.***

Applying to grad school: Your Curriculum Vitae

- *Curriculum Vitae* is Latin for *course of life*.
- A c.v. is more detailed, and usually more academics-focused, than a résumé, but is similar in format. It can be longer, though, usually at least two pages, so don't use tiny fonts! (The people reading your application are probably old!)
- You should include...
 - *Academic history, include your GPA (optional).*
 - *Research interests (put something, even if you are not sure).*
 - *REUs and other research projects, with abstracts.*
 - *Teaching experience (grader, calculus help sessions, tutoring, everything).*
 - *Awards, honors, etc.*
 - *Relevant work experience.*
 - *Your name and contact info. **Bold** your name. You want them to notice & remember it.*
 - *Make a website & include the URL.*

Applying to grad school: Your Curriculum Vitae

- You should include...
 - *Relevant skills, like programming language proficiency, foreign languages, professional certificates, etc.*
 - *Relevant service to the community and volunteer work, like Math Circles.*
 - *List advanced courses and reading courses (annotate, if appropriate, and include textbook name & author).*
 - *If you have done relevant big projects for courses, list and describe them.*
 - *Professional affiliations (AWM, AMS, MAA, etc.), and any offices you've held in these.*
 - *Any funding you received (summer research stipend, etc.)*
 - *Conference presentations/posters.*
 - *Published articles (if any) or articles in prep.*

Applying to grad school: Your Curriculum Vitae

- You should not include...
 - The two weeks you worked at Dairy Queen when you were 15.
 - Just about anything else that happened in high school.
 - Your birthday, SSN, immigration/visa information, marital status, or other personal information.
 - A list of soft skills sometimes included on a résumé like, “I’m a team worker,” or “excellent problem-solving skills.”
 - A photograph of yourself.
 - *Weird fancy fonts*, lots of colors, **FONT-SIZE CHANGES**, & **stuff**—keep it simple!
Use bold and *italics* for emphasis, but sparingly.
- An example. And some more.

As you put together your application, keep the process in mind.
Make it easy for someone to advocate for you.

Applying to grad school:

The personal statement

- “..(the PS) provides additional evidence of your intellectual and creative achievement. The essay is also the only opportunity for the readers of your application to get a feel for you as a person as well as for you as a student. The essay is also the place where you can put your academic record into the context of your opportunities and obstacles. “-(Berkeley)
- “The personal statement should be a comprehensive narrative essay outlining significant aspects of your academic and personal history, particularly those that provide context for your academic achievements and educational choices. Quality of writing and depth of content both contribute toward a meaningful and relevant personal statement.” -(U of W)
- “...they're likely looking for you to demonstrate that you've given some thought to what you want to do in the graduate degree [program] and with your future. It's fine if you don't know. No one is going to hold you to what you state. But here they want to know that you've done some research into what you're getting yourself into and what your motivations are for pursuing the degree.” – (www.physicsforums.com)

Applying to grad school:

The personal statement

- This is really a cover letter for your application, and you can format it like one.
- Make **absolutely sure** it is grammatically correct. Ask other people to read it and read it out loud to yourself 100 times.
- Write about what you've experienced/loved in the advanced courses you've taken. If you've done a reading course or self-studied something hard, describe it and include the name of the text you used and its author.
- Describe any research experiences.
- Talk about awards, competitions, etc.
- This is your only chance to address any holes or weaknesses in your application [COVID times get weird?].
- Target it to the individual schools: Describe what parts of mathematics appeal to you and make sure it's consistent with the school's strengths.
- **Ask your faculty (i.e., us!) to read your statement and give you feedback!!!**

Applying to grad school:

The personal statement (tips swiped from the internet)

■ Things to try to do:

- *Write directly and in a straightforward manner that tells about your experience and what it means to you.*
- *Form conclusions that explain the value and meaning of your experience, such as what you learned about yourself and your field and your future goals. Draw your conclusions from the evidence your life provides.*
- *Be specific. Document your conclusions with specific instances.*
- *Get to the point early on and catch the attention of the reader.*
- *Limit its length to two pages or less, 1.5 spaced. In some instances, it may be longer, depending on the school's instructions.*

■ Things to avoid doing:

- *Using the "what I did with my life" approach, or the "I've always wanted to be a _____" approach.*
- *Using a catalog of achievements. This is only a list of what you have done and tells nothing about you as a person.*
- *Lecturing the reader. For example, you should not write things like, "Communication skills are important in this field." Any graduate admissions committee member knows that.*

As you put together your application, keep the process in mind.

Make it easy for someone to advocate for you.

Applying to grad school:

Letters of recommendation

- This is probably the most important part of your application, and all you get to do is ask someone else to do it for you. Plus, you don't even get to see it!
- Choose faculty with whom you have taken **advanced** courses and done well.
- You should ask faculty if they would be willing to write you a letter in the spring of your junior year (if possible). Be polite (say "please" and "thank you"), and promptly send a thank you email with your c.v. attached.
- Gently remind them in the fall.
 - *"Hi! How was your summer? I just wanted to check in and ask if you are still willing to write a letter for me. My updated cv and draft personal statement are attached. Thank you so much!"*
- Write again right before you submit their name as a writer.
 - *"Hi! I just wanted to give you a heads up: I'm about submit my applications. The universities will send you links for you to submit your letter. You should get links from the following universities: [Include a list.] Thank you so much for writing on my behalf!"*

Don't take it hard if someone says they feel they can't write you a good letter; it does not mean they don't like you, or that they don't think you should go to grad school.

Applying to grad school: Overall

- Research the universities to which you think you might want to apply—scour the website, read faculty bios, about research groups there, grad students' websites, and take notes. (You can use things that appeal to you to tailor your cv and personal statement.)
- Ask us (faculty) for feedback on your personal statement & C.V.
- Try to make your application easy to read (no tiny fonts!). *Make it easy for the person on the committee that reads your application to make a case for you.*
- Remember you should be **selling yourself**; now is not the time to be humble! Don't lie or misrepresent anything but be proud of your accomplishments and make sure the admissions committee knows how great you are. 😊

Good luck!!!

[Annotated example c.v.](#) And [some more](#). And [even more!](#)

[GRE Subject Test information](#)

[Find a grad program \(AMS\)](#)

[What's the first year like? \(AMS\)](#)

Applying to grad school: The GRE

■ GRE General Test

- *It's offered all the time.*
- *Often required by the university.*

■ Subject Test in Mathematics

- *Only offered 3 times per year.*
- *66-question, multiple-choice paper test with a 3-hour time limit.*
- *50% calculus (ALL of Stewart), 25% algebra (basic, linear, abstract), 25% other topics (topology, logic, discrete math, probability, numerical analysis).*
- *This test is hard, but not as important to your application as your letters and personal statement.*
- *You should take the test in the spring semester of your junior year if possible.*
- *Most, but not all, Ph.D. programs require this test.*

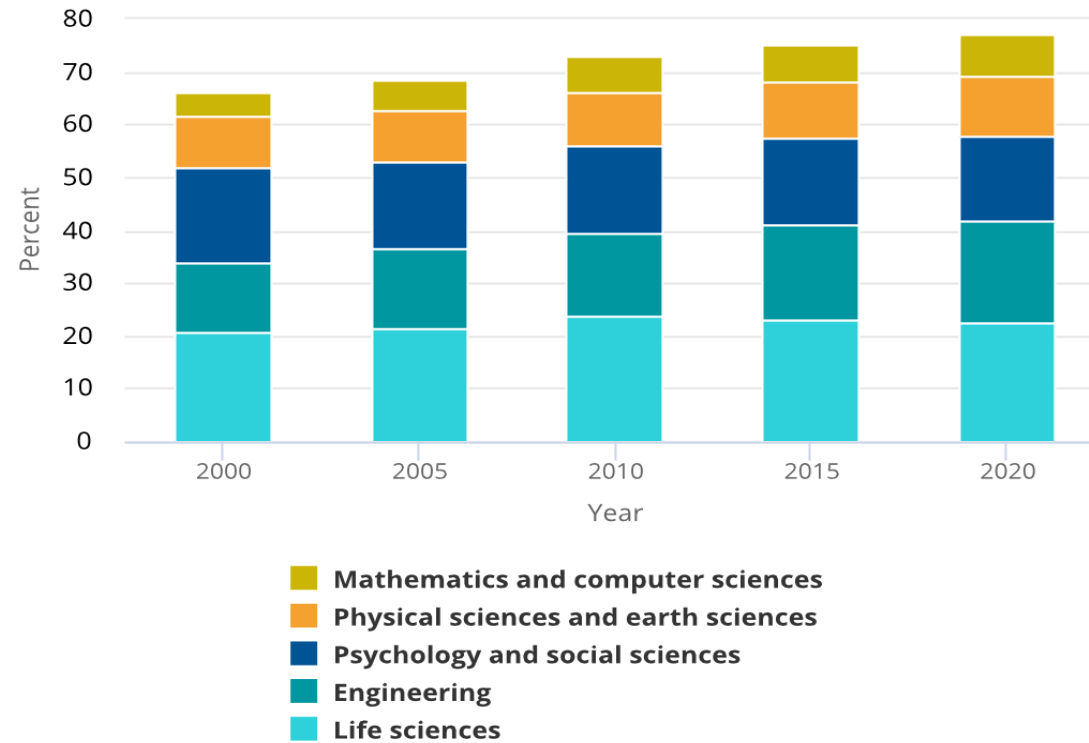
Test Dates	Registration Deadlines		
	Regular Deadline	Late Deadline ¹	Supplementary Test Center and Monday Administration Deadline ²
09/17/22	08/12/22	08/19/22	07/29/22
10/29/22	09/23/22	09/30/22	09/09/22
04/08/23	03/03/23	03/10/23	02/17/23

Applying to grad school: Preparing for the Math Subject GRE

- Do a GRE Subject Math practice test from the ETS.
- Manage your expectations:
 - *50th percentile. Master **all** of Stewart’s calculus.*
 - *80th percentile. Master “Cracking the GRE Mathematics Subject Test” by Steven Leduc.*
 - *99th percentile. Master undergraduate mathematics.*
- 50th percentile is not bad... Remember, this is a highly selective group of people to start with!
- Take multiple practice tests, and don’t panic if the actual test seems hard—they get harder every year! But they are scored as percentiles, so everyone is in the same boat.
- Some [sample problems](#).

Figure 7

Doctorates awarded in S&E broad fields of study: Selected years, 2000–20



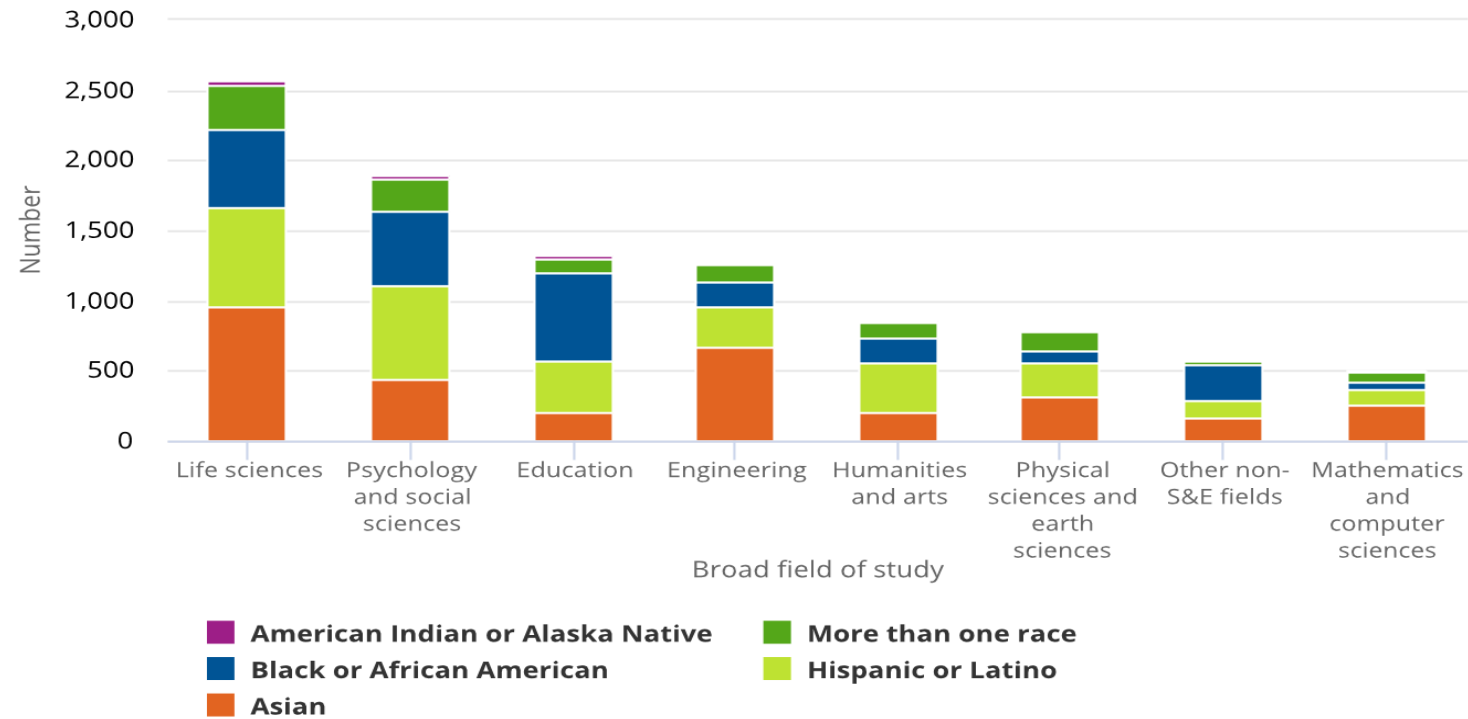
S&E = science and engineering.

Source(s):

National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2020. Related detailed table 4, table 7, table 12, and table 13.

Figure 10

Doctorates awarded to minority U.S. citizens or permanent residents, by selected race, ethnicity, and broad field of study: 2020



S&E = science and engineering.

Note(s):

Excludes U.S. citizen and permanent resident respondents who did not report race or ethnicity or were Native Hawaiian or Other Pacific Islander. Hispanic or Latino may be any race.

Source(s):

National Center for Science and Engineering Statistics, Survey of Earned Doctorates, 2020. Related detailed table 23 and table 24.