

# BIOINFORMATICS PROFESSIONAL SPECIALIZATION

*ONLINE COURSE - ILT*

Develop a deep understanding of bioinformatics & acquire the skillset to support you in curating and implementing its various facets.

63 hours of ILT - sessions

15 hours of TA - sessions

23 hours of self-paced content

*GET IN TOUCH*

## OVERVIEW

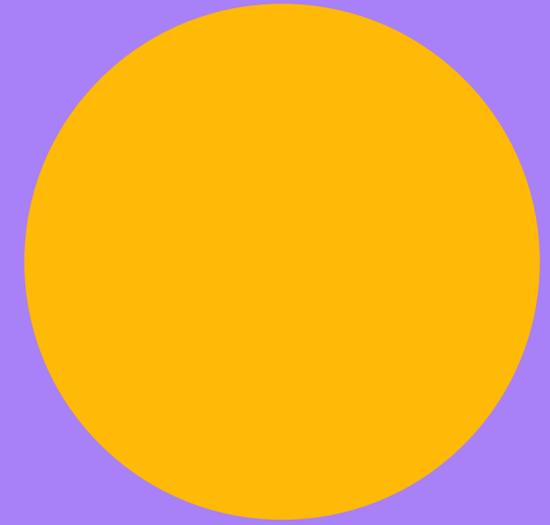
Bioinformatics is booming the computational healthcare and life sciences market, with a superior exponential growth rate! Yet, getting hired in a bioinformatics job requires a double competence in the fields of computer science and domains like healthcare, life sciences as well. Studies show the big struggle that lies behind slowing recruitment operations in such positions which goes first to the huge lacking of practical knowledge and the experience should candidates have for certain positions.

Phi Education comes to put up this professional specialization in Bioinformatics, as a way of tackling this gap in the practical facet, to be able to build as you learn along your studying path. Bioinformatics involves the development and application of tools to make biological discoveries, usually, people who enter the field from a biological background need to learn how to utilize tools to do discoveries. However, bioinformaticians from engineering backgrounds/CS are most likely to build these tools. In this specialization, you will learn both programming and biological bases as well as statistics to earn the advantage of maximizing your capabilities in curating and implementing.

## Graduates of this specialization will be able to walk away with:

- Hands-on experience in programming tools
- Understanding of the biological concepts and basics of genetics, molecular biology as well.
- Ability to perform basic statistical analysis for biological problems and to locate bioinformatics data and information in public resources.
- Ability to analyze NGS data, and RNA-seq data
- Understanding of the role of bioinformatics in certain pipelines.





**Bioinformatics is changing the world of healthcare today, and through Phi education program you can create that change.**



Dr. Basel Abu Jamous  
*Lead of the Bioinformatics  
Pro Specialization*

# SYLLABUS

Build and refine your knowledge of bioinformatics principles and practices as you work through the weekly modules of this online specialization.

## PHASE I: INITIAL COURSES

20 CREDITS

### COURSE 1: PYTHON FOR BIOINFORMATICS

PREREQUISITE COURSE

8 HRS - ILT

Programming is the tool with which bioinformaticians implement and execute their ideas and analyses. The two most widely used programming languages for bioinformatics are Python and R, where the former is more dominant in the industry while the latter is more dominant in academia. This course covers the essentials of the Python language including the Python data science stack, which is the set of Python packages needed for the analysis of data, including bioinformatics data. The course will emphasize the practical side of assignments. Importantly, this course also covers the basics of usage of the Linux operating system, as most bioinformatic analysis is done within it. Students will have free access to learn Python and do their tasks on the DataCamp platform, they have to complete 1 course at least every week, their instructor will meet them once a week to follow up on their progress.

#### OUTCOMES:

- Hands-on experience with Python tools for data science
- Hands-on experience with the essentials of Linux as needed by bioinformaticians

#### SCHEDULE:



**Lecturing days:** due to the different allocation of lecturers around the world, **lectures are supposed to be conducted on Saturday** on weekly basis over the month.



**Lecturing times:** teaching hours will be conducted afternoon - due to the difference between time zones, in the period of **4:00 Pm - 9:00 Pm (KSA)** on a time average 2h per session.

WEEK 1

2 HRS - ILT

The Python language essentials / The python data science stack

- **DataCamp Course:** Introduction to python
- **Assignment:** Illumina's hap.py question (source I)

WEEK 2

2 HRS - ILT

Python data science stack

- **DataCamp Course:** Data Manipulation with Pandas
- **Assignment:** LTEE E.coli question (source II and III)

WEEK 3

2 HRS - ILT

The Python language essentials / Visualization

- **DataCamp Course:** Intermediate python
- **Assignment:** Biological Sequences question (source IV)

WEEK 4

2 HRS - ILT

Visualization

- **DataCamp Course:** Introduction to data visualization with Matplotlib
- **Assignment:** Zika Virus question (source V)

# SYLLABUS

## COURSE 2: MOLECULAR BIOLOGY

PREREQUISITE COURSE

8 HRS - ILT

Bioinformatics is all about the analysis of genetic data to try to understand the biology of cells in health and disease. Without a clear understanding of the basics of genetics and molecular biology, no bioinformatician can perform meaningful analysis. This course covers all of the essential biologies that a bioinformatician needs to start. No previous understanding of biology is required here. This course is the starting point.

### OUTCOMES:

- Sufficient understanding of genetics and molecular biology
- Recognition of the biological concepts and terms needed in bioinformatics, such as genes, proteins, DNA, RNA, and so on.

### SCHEDULE:



**Lecturing days:** due to the different allocation of lecturers around the world, **lectures are supposed to be conducted on Saturday** on weekly basis over the month.



**Lecturing times:** teaching hours will be conducted afternoon - due to the difference between time zones, in the period of **4:00 Pm - 9:00 Pm (KSA)** on a time average **2h per session**.

### WEEK 1

1 HRS - ILT

Introduction to molecular biology

1 HRS - ILT

Cells: eukaryotes and prokaryotes

- Weekly Assignment
- Self-Paced Content

### WEEK 2

1 HRS - ILT

The central dogma of molecular biology

1 HRS - ILT

DNA, RNA, and protein structure

- Weekly Assignment
- Self-Paced Content

### WEEK 3

1 HRS - ILT

Transcriptional regulation

1 HRS - ILT

Post-transcriptional processing & alternative splicing

- Weekly Assignment
- Self-Paced Content

### WEEK 4

1 HRS - ILT

Cancer and latest bioinformatics research

1 HRS - ILT

Stem Cells

- Weekly Assignment
- Self-Paced Content

# SYLLABUS

## PHASE II: CORE COURSES

52 CREDITS

### **COURSE 1: BIOINFORMATICS I - A BROAD FOUNDATION OF THE ESSENTIALS**

22 HRS - ILT

This course serves as a broad foundation in bioinformatics. It spans numerous topics such as bioinformatics data types and resources, biostatistics, machine learning, gene expression cluster analysis, gene functional analysis, enrichment analysis, and differential expression. These concepts as introduced in this course are used to build advanced courses in this specialization and beyond on top of them. Without this broad foundation, the bioinformatician will never be able to understand advanced topics solidly.

#### OUTCOMES:

- The ability to locate bioinformatic data and information in public resources
- Performing basic statistical analysis for biological problems
- Performing gene expression clustering analysis
- Performing gene enrichment analysis
- Performing differential expression analysis

#### SCHEDULE:



**Lecturing days:** due to the different allocation of lecturers around the world, lectures are supposed to be conducted on Saturday & Wednesday on weekly basis over the month.



**Lecturing times:** teaching hours will be conducted afternoon - due to the difference between time zones, in the period of 4:00 Pm - 9:00 Pm (KSA), on a time average of 2-4 h per session.

#### WEEK 5

1 H  
1.5 HRS  
1.5 HRS

The definition, scope, and applications of bioinformatics  
Omic technologies and datasets  
Bioinformatic resources and databases

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

#### WEEK 6

2 HRS  
3 HRS

Introduction to bio-statistics  
Bioinformatic data pre-processing and standardization

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

#### WEEK 7

1.5 HRS  
1.5 HRS

Machine learning: peeling the surface  
Gene expression clustering

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

#### WEEK 8

2 HRS  
2 HRS

Gene Ontology and enrichment analysis  
Differential expression analysis

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

# SYLLABUS

## COURSE 2: BIOINFORMATICS II - NEXT-GENERATION SEQUENCING DEEP DIVE

22 HRS - ILT

Next-generation sequencing (NGS) technologies emerged around 2006 and grew exponentially since then. They have been used to innovate and create numerous technologies that produce large amounts of data requiring analysis. This course provides a deep dive into NGS data and its analysis pipelines. The main focus will be on the two most common types of NGS data, whole-genome sequencing (WGS) and RNA-sequencing. With plenty of hands-on experience through assignments, students will be able to perform this essential analysis in any academia or industry setting, which is a highly demanded skill.

### OUTCOMES:

- Hands-on analysis of next-generation sequencing (NGS) data from raw format, mainly whole-genome sequencing (WGS) and RNA-seq data
- Visualisation of genomes and genomic tracks in the genome browser

### SCHEDULE:



**Lecturing days:** due to the different allocation of lecturers around the world, lectures are supposed to be conducted on **Saturday & Wednesday** on weekly basis over the month.



**Lecturing times: teaching hours will be conducted afternoon** - due to the difference between time zones, in the period of **4:00 Pm - 9:00 Pm (KSA)**, on a time average of 2-4 h per session.

### WEEK 9

1 HR  
3 HRS

The next-generation sequencing (NGS) technology  
NGS data preprocessing

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

### WEEK 10

1 HR  
3 HRS

Whole-genome sequencing (WGS) data  
De novo assembly and variant calling

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

### WEEK 11

2 HRS  
2 HRS

Genome browser and visualization  
GWAS

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

### WEEK 12

4 HRS

RNA-seq data and gene expression

- Weekly Recap
- SessionWeekly
- AssignmentSelf-Paced Content

# SYLLABUS

## **COURSE 3: BIOINFORMATICS III - AN OUTLOOK OVER ADVANCED TOPICS**

8 HRS - ILT

After having learned a strong broad foundation in bioinformatics I and a deep dive in NGS data analysis in bioinformatics II, this course takes the students in a tour over a number of advanced topics and applications. This enlightens the horizon of students as to what topics they may pursue in further reading or research. The topics include bioinformatics for drug discovery, which is the scope of a large number of biotech and big pharma companies worldwide. The students are also introduced to the analysis of clinical data, which has numerous applications in clinical settings such as in hospitals. Furthermore, students are introduced to bioinformatic scopes beyond human genetics as they learn about metagenomics and phylogenetics and their applications in microorganisms, animals, and plants. Finally, an introduction to multi-omic analysis is provided, highlighting the power of modern integrative analyses in which multiple bioinformatic datasets are analyzed collectively in more complex pipelines.

### OUTCOMES:

- Understanding of the drug discovery pipeline and the role of bioinformatics in it
- Appreciation of the value, scope, and power of integrating clinical data with omic data
- Recognition of the special analyses applicable to collections of genomes (e.g. meta-genomics)
- Acknowledgement of the power and application of the collective analysis of multiple omics datasets

### SCHEDULE:



**Lecturing days:** due to the different allocation of lecturers around the world, **lectures are supposed to be conducted on Saturday on weekly basis over the month.**



**Lecturing times:** teaching hours will be conducted **afternoon** - due to the difference between time zones, in the period of **4:00 Pm - 9:00 Pm (KSA)**, on a time average of 4h per session.

### WEEK 13

2 HRS

Bioinformatics for drug discovery

2 HRS

Meta-genomics and phylogenetics

- Weekly Assignment
- Self-Paced Content

### WEEK 14

2 HRS

Integration with clinical data

2 HRS

Multiomics

- Weekly Assignment
- Self-Paced Content

### **BUILD A REAL-WORLD PROJECT**

10 HRS - ILT

Learn and apply! As a complementary part of this specialization, and under the supervision of your instructor, you have to finish building a real-world project to get graduated. Participants will be required to put the theoretical and practical skills that they learned in a final project in which they will analyze real biological data. This will be a good chance to incorporate different bioinformatic concepts learned throughout the course in a single project serving a real purpose.

#### OUTCOMES:

- Hands-on experience on a real-world data full project

#### WEEK 7

- Team formation and project selection

#### WEEK 9

- Literature review

#### WEEK 10

- Design and implementation

#### WEEK 15,16

- Documentation
- Presentation & Graduation Day

#### TOPICS:

Human cancer project, bacteria project, plants project, multi-omic project

## PROGRAM REWARDS

### Mentorship session

Graduates who successfully did it to the finish line will have the opportunity to attend Peer-to-Peer sessions, to get career advice based on their progress and evaluation along with the specialization. Besides all that, they will be supported in building their LinkedIn profiles to appear with a professional look. Moreover, they might get endorsed to pursue a certain position in the field. Your instructors will be also part of your connections network, this will let you build great potential & bring you superior opportunities.

### Well recognized portfolio

You will prepare a portfolio that will give you the opportunity to show your potential employers what you can actually do. In this portfolio, you can include the bioinformatician project you have worked on during the cohort.

### Your Certificates

#### Certificate of Completion

Earn your completion certificate, and get your recognition of your newly developed skills.

Assessment is continuous and based on a series of practical evaluations completed online on Phi's LMS & completed a comprehensive application of a real-world project. In order to be issued with a Phi certificate of completion, you'll need to meet the requirements outlined in this course guide brochure. The brochure will be made available to you as soon as you begin the course.

Your certificate will be issued in your legal name and sent to you upon successful completion of the course, as per the stipulated requirements.

#### Certificate of Recognition

To get an honorable mention on a certificate, you should come up with a total grade in both the project and practical evaluation that exceed %85.

#### Recommendation Letter

You can earn such a letter signed by your instructor once complete your final project.

# JOIN & LEARN WITH THE BEST



PROGRAM LEAD

## Basel Abu Jamous

LEAD BIOINFORMATICIAN

Dr. Basel is a lead bioinformatician who's aspiring to develop and apply the next generation of bioinformatics, data science, artificial intelligence, and machine learning to facilitate leveraging multiomic data in order to address the critical problems facing pharmaceutical industry, mainly the drug discovery. His geekness in framing analyses in the context of the underpinning biology made him one of the youngest dominant scientists in the field.

INSTRUCTOR

## Dr. Rana Dajani

PROFESSOR

A Tenured Professor at Hashemite University, Jordan. Earned her Ph.D. in molecular biology from the University of Iowa. Dr. Rana has a great history full of many honorable achievements & awards, and she's a visiting professor at Cambridge & Yale universities.

Dr. Rana also is a writer in Science & Nature, the most influential women scientist in the Islamic world, founder of the initiative "We love reading" and author of the book: Five scarves, Doing impossible: If we can reverse cell fate why can't we redefine success. Dr. Rana was awarded the Jordan star of science by King Abdullah II.



INSTRUCTOR

## Dr. Haitham Ashour

PRINCIPLE DATA SCIENTIST

Haitham Ashour, is a Principal Data Scientist at the Janssen Pharmaceutical companies of Johnson & Johnson, working on developing & applying machine learning methods for analyzing noisy complex biological data.

Mr. Ashour holds a PhD degree in the computational Biosciences earned from King Abdullah University of Science & Technology (KAUST), He has over 3 published papers & projects on Databases analysis, integration as well. He aspires to improve a comprehensive perception of the Genome.



INSTRUCTOR

## Dr. Wail Ba-Alawi

AFFILIATE SCIENTIST - BIOINFORMATICIAN

Wail Ba-Alawi, is an Affiliate Data Scientist - Bioinformatician, responsible on advancing research projects and scientific discoveries within Princess Margaret Cancer Centre through the analysis of big data using Machine Learning, Computational Biology and Bioinformatics. Dr. Ba-Alawi is a detail-oriented professional with +4 years of experience in collecting, analyzing, and interpreting large datasets; developing robust predictive models; and setting standards for data management. Strong problem-solving and analytical skills, and a significant ability to work in team environments. He earned his PhD degree in CS from the King Abdullah University of Science & Technology - KAUST, within over 10 published papers and 4 Honorable mentions and awards. Wail aslo aiming to leverage my skills and knowledge to solve real-world problems



INSTRUCTOR

## Ahmad Jadallah, M.D.

CHAIRMAN AT PHI SCIENCE

Ahmad graduated from the school of medicine in 2017 and afterward decided to dedicate his efforts to developing products and launching start-ups in biotech, bioinformatics, and deep tech education. He led several executive roles in the start-up ecosystem, and currently leading Omica.ai, a biotech venture working in the field of multi-omic data analysis for cancer drug discovery. He is a science passionate and a communicator of science and technology.



# JOIN & LEARN WITH THE BEST



TEACHING ASSISTANT

## Hiba Shaaban

*MSC BIOINFORMATICS/ UNIV. OF SOUTH FLORIDA & CURRENTLY A BIOINFORMATICS ANALYST AT Q2 SOLUTION, USA*

Hiba Shaban is a Bioinformaticist at Q-squared Solutions in Research Park, North Carolina, working with clients in the healthcare field to facilitate the bioinformatic analysis of sequenced samples. Hiba obtained her master's degree in Bioinformatics and Computational Biology from the University of South Florida, & has 5 years of experience in the field and is passionate about performing feasibility and validation analyses of assays to provide clients with evidence of reliability and reproducibility of Q-squared Solutions' bioinformatics data from primary and secondary analyses under different conditions.

TEACHING ASSISTANT

## Hatem Almutairi

*SENIOR LABORATORY SPECIALIST, SA | PH.D. BIOINFORMATICS, UK*

Hatem is an experienced Laboratory Specialist with a demonstrated history of working in the government administration industry in Saudi Arabia. Skilled in Research, Statistical Data Analysis, and Data Analysis. His Master of Science (MSc) focused on Molecular biology of parasites and disease vectors from Liverpool School of Tropical Medicine, and he obtained his Ph.D. in Bioinformatics & Computational Biology from the University of Lancaster.



# FREQUENTLY ASKED QUESTIONS

## Who this course is suitable for?

This course is ideally suited for those who are striving to start their career path in Bioinformatics. No specific disciplines are precisely fit for this specialization, nor a certain required experience. However, students who are expected to achieve high results are those who have graduated from STEM, medical, and Life Sciences fields, and juniors who are already pursuing a position in such fields.

## Can I skip a certain course?

Not exactly, you can only waive courses in the initial phase (prerequisites kit). We recommend you to apply and join these foundational courses, to learn basic components before digging deep into the advanced level since the whole curriculum is designed following the synoptic methodology. You can waive these courses upon your responsibility if your submitted documents met our criteria. (Read more in the student guide)

## Is this program accredited?

This specialization program is non-academia-recognized. Our Bioinformatics professional training kit is designed and developed in collaboration with the industrial leads in the field, learning outcomes and the curriculum are articulated to meet market-based and in-demand skillset in such vacancies globally and regionally. Once completed the program, you will be qualified to apply for entry-level jobs in the field.

## I'm not experienced at programming, can I apply?

You don't need to be knowledgeable in any programming language (otherwise it's a plus). Once you enroll in this training program, you will get free access to the DataCamp platform to learn the preliminaries of coding in Python programming. Your mentor will meet you in a live session weekly to check your progress. Remember, the more practicing you do, the faster at scale you will set apart in this job market.

## Is financial aid available?

As part of paying back to our society, Phi is glad to provide up to 2 full scholarships for any of its specializations. Please submit your application form. Moreover, you can get your early-bird registration discount when enrolling in any of the announced programs 2 weeks at least before the kick-off day.

# FREQUENTLY ASKED QUESTIONS

## How long is each course?

1 month. Each course will include instructor-led sessions, held weekly for over 4 weeks.

## What are ILT sessions?

Instructor-led training. In which students can engage synchronously with the teacher, they are totally privileged, in contacting their instructors and learning from their expertise directly. ILT classes will include hands-on practices in terms of maximizing knowledge retention.

## How can I communicate with the instructor?

You can ask your questions during the lecture, or even contact the teacher on Phi's LMS or by their emails. You can also connect with your TAs during the week.

## How can I discover the online campus?

The Online Campus will be your virtual classroom on Phi LMS for the duration of your course. Through its easy-to-use interface, you'll have access to a diverse variety of course content formats including interactive materials, module notes, presentations, assignment briefs, and additional web resources.

On the Online Campus, you'll also be able to ask questions and interact with your fellow students, & teaching team through the discussion forums, attend your live classes on ZOOM inside the platform. Should you complete your enrollment, you will receive total details and instructions to build your account there.

## What is the difference between “Specialization” and “Courses”?

In Phi Science, we work to provide the best-personalized learning experience in collaboration with world-class professionals, to build a whole training program that supports participants in developing a new skillset as going over courses along with the phases (from Prerequisites to the final project).

## JOIN YOUR ALUMINIES

A very informative introductory course to the field of bioinformatics. It covers the main steps you need to go thru in a typical pipeline of bioinformatics analysis and in a hands-on type of instruction, which adds a lot to the learning experience. The instructor was knowledgeable and super friendly.



**Israa Haj-Husein**

Ph.D. Student - McGill University



An excellent course; I highly recommend it. It's comprehensive, well structured, practical, and valuable.



**Yasmeen Dodin**

Researcher - KHCC-King Hussein Cancer Center



It was a very distinctive experience, especially as it was being led by the expert Dr. Basel Abu Jamous in this multidisciplinary field. I highly recommend anyone interested in acing this science to join such a practical course since bioinformatics is one of the promising fields nowadays.



**Yazan Al Hroob**

Data Analyst - Umniah





PHI  
SCIENCE



PHI.SCIENCE



US: +1 617 870 9667 | JO: +962 79 653 6079



INFO@PHI.SCIENCE