

MEDSCI 101 BOOKLET



**The Future of Medical
Science Pillar!**



Preface

At the beginning of my term, I had a vision of science that I wanted to raise all across Europe. ***Scientific thinking should be appreciated by medical students***, considering it's not only essential to apprentice it through reading articles and lecture textbooks but also crucial for improving clinical decision making as future doctors.

Since the foundation of the Medical Science Pillar in EMSA, tremendous accomplishments are managed by valuable people. Our pillar is very unique in many ways when compared to other student organisations' scientific work, and ***in fact, our original ideas even inspire lots of healthcare students in Europe.***

Therefore, we decided to have a comprehensive Medical Science 101 Booklet to improve our members' quality of knowledge regarding our pillar.

As the Medical Science team of 2019/20, we believe that our organisational memory is highly capable of encouraging future advocates of medical science. The only way to accomplish this was possible with the content created **by medical students for medical students.**

During the process of this booklet, I've witnessed the collaboration of people from different backgrounds to discuss matters that every medical student should care about; especially science. As Pasteur once said '*Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world*'.

All in all, I believe that ***the MEDSCI 101 Booklet*** will be a great reference source for the valuable *Medical Science enthusiasts of EMSA and be the auxiliary power supply whenever needed to improve the efficiency of their work.*

Berkay Akad Ülker
Medical Science Director, 19/20

Preface

MEDSCI 101 Booklet is the **outcome of a six-month effort** with very precious people. In the process of preparations, we have done a great amount of research and have asked our FMO's for their valuable input. Our focus was to make **Medical Science Pillar well-understood** both by Local Pillar heads and newcomer EMSAi.

This booklet has thought me how critical teamwork is once more and has expanded my knowledge on activities on FMO level. I believe we have **made a strong case** of how vast Medical Science Pillar is by publishing this booklet. I am eager to see EMSAi benefiting from the booklet and implying the **basics of Medical Science** in their FMO's.

I am very grateful for every single person who has contributed to this booklet and I hope you enjoy reading the content as much as we did!

Sude avdarođlu
PR&External Assistant of MedSci, 19/20

Preface

When I became the Medical Science Research and Internal Assistant, one of my main goals was to make Medical Science more prominent in local FMOs and inspire people to get involved. Even though I talked to many highly motivated local MS Directors that had the same intentions, they often had issues implementing projects related to Medical Science in their FMOs. This booklet is supposed to be a guideline, especially for first-time MS Directors, and all EMSA members that are interested in Medical Science and want to be more active. In the FMO Development section of this booklet, they can get inspired by many project ideas and find useful tips on how to realize their favourites. It includes projects proposed by FMOs who already implemented them on a local or national level, as well as new project ideas that have never been done before. We are looking forward to seeing more and more of these projects being realized in FMOs all around Europe!

Daniela Koch

Research&Internal Assistant of MedSci, 19/20

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*Definition
of*

MEDICAL SCIENCE





MEDICAL SCIENCE DEFINITION

Medicine is a discipline aiming to find cures & prevent diseases and promote health while science is a systematic accumulation of knowledge arising from research and experiments. The term medical science combines these two concepts and looks into the development of medicine with research and studies.

Medical Science is a field of research which comprises the essential occupations of medicine, such as diagnosing, treating, and preventing diseases as well as the maintenance of human health. It has an important role in the development of medical studies through its contributions to the achievement of contemporary scientific data by the ongoing research carried out within the scope of medical science.

Medical Science pillar intends to expand medical students' scientific perspective while increasing the respect shown to science and scientists. It raises appreciation among our society through promotional activities introducing the key principles and benefits of medical science.



Medical Science pillar aims to provide the basic knowledge on the procedure of scientific research, which is essential for every future healthcare professional while equipping them with up-to-date information through the latest research results. It provides a space where medical students and European researchers can interact and exchange their knowledge and practices. This pillar introduces medical science to those medical students who are interested in becoming a future researcher and helps them to construct a strong base for their professional scientific careers.

Medical Science introduces the scientific methodology and research. It acknowledges the fact that the supreme guide in life is science. It guides medical enthusiasts on how to advocate medical science and approach.

It leads a path for passionate medical students for pre and post-graduate research opportunities. Medical science pillar intends to expand collaborations and networks. It encourages medical students to read and publish articles while guiding them to extend their theoretical knowledge and practical skills.

Medical Science pillar aspires to raise awareness of the importance of science and intends to generate medical students that appreciate the significance of the scientific approach and take science as their primary guide in every part of their lives.



Medical Science pillar gathers people from different faculties as well as several disciplines into a collaboration in the cause of science, creates a space where different ideas can freely be expressed and discussed, and also encourages students to produce innovative ideas. It aims to provide a scientific discussion platform in which individuals are respectful of one another's ideas and this platform gives chance to people to develop their ideas.

It aims to inform medical students about the theoretical knowledge and practical skills that every healthcare professional should gain before graduation and helps them to earn those scientific abilities and global qualifications by encouraging them to ask scientific questions.

Medical Science pillar encourages medical students to conduct scientific activities and helps them to improve themselves by gaining experience in various fields through the national and universal scientific activities it provides.

Medical Science pillar's main aim is to generate a Europe that prospers in the field of medical science and encourage students to engage actively in advancing healthcare through scientific research.

It encourages medical students to follow scientific publications by giving them an opportunity to build a robust future career.

Medical Science pillar enhances medical students' ability to think scientifically and analytically whilst promoting the scientific approach in every medical field and fields of student interest.

Role of the Medical Science Directors

The role of local Medical Science Directors comprises many different responsibilities and depends on their FMO's structural organization. Nevertheless, a Medical Science Director has defining attributes. These fundamental traits signify the distinctions between a Medical Science Director and other Directors.

Medical Science Directors must consider themselves first and foremost as an enthusiastic advocate for medical science. They should arouse feelings of curiosity and canalize others' curiosity in a more productive way. Given their motivation, they must think at the margins. They must think in a creative perspective to encourage themselves and the members. A director can encounter issues due to a lack of interest. Thinking in a creative sphere either renews members' motivation or awakes an excitement about the subjects of medical science. Coming up with new projects, being able to round up new members, providing a strong base for students for their professional scientific career by offering various workshops and scientific projects and never getting tired are important skills of a creative director.

Furthermore, she/he must be socially active to gather inspiration from other directors and promote inter-pillar working groups. Staying in touch with other FMOs and national Medical Science Directors regularly facilitates medical science progression on national and European levels. In addition, they are responsible for contributing to projects planned by the EMSA European Board Medical Science Team.



Moreover, one of the most fundamental missions of MS Directors is introducing “research” to people. Medical Science Directors need to know how to conduct a literature review and write a research paper. Moreover, one of the most fundamental missions of MS Directors is introducing “research” to people. Medical Science Directors need to know how to conduct a literature review and write a research paper. Furthermore, they should be able to convey their research skills to medical students. Other efficient ways to teach students more about research is promoting interactions with local research centers and the coverage of research in the medical curriculum of the university.

All in all; a little knowledge, endless curiosity, a spark of motivation, and preferably some experience is enough to be a dedicated local Medical Science Director.



IDEAS FOR FMO ACTIVITIES



INTRODUCTION: STORY OF JOHN BROWN

John Brown, the Medical science director of EMSA Holyport, is pursuing his third year of medicine from Onurg Faculty of Medicine, Holyport. He is thinking about possibilities to cheer up his FMO up. John needs some inspiration to come up with a creative idea. Making something different in medical science with his FMO is one of the most significant achievements that he wanted to do during his directorship. While John was thinking and searching through the media, he discovered the FMO section of EMSA Europe's MedSci 101 Booklet.

This section contains what he is looking for:

New ideas for activities, creative exercises based upon Medical Science to perceive the pillar more predominantly and help to maintain the capacity of Medical Pillar from across Europe...

Let's look through this section and help John and others construct some ideas on how they can improve their FMO!

LIST OF CONTENTS: PROJECT IDEAS



- **Collaborative Projects**

- AMR Awareness
- Research Awareness Campaign
- Café Scientifique
- Research & Medicine
- Getting to know research

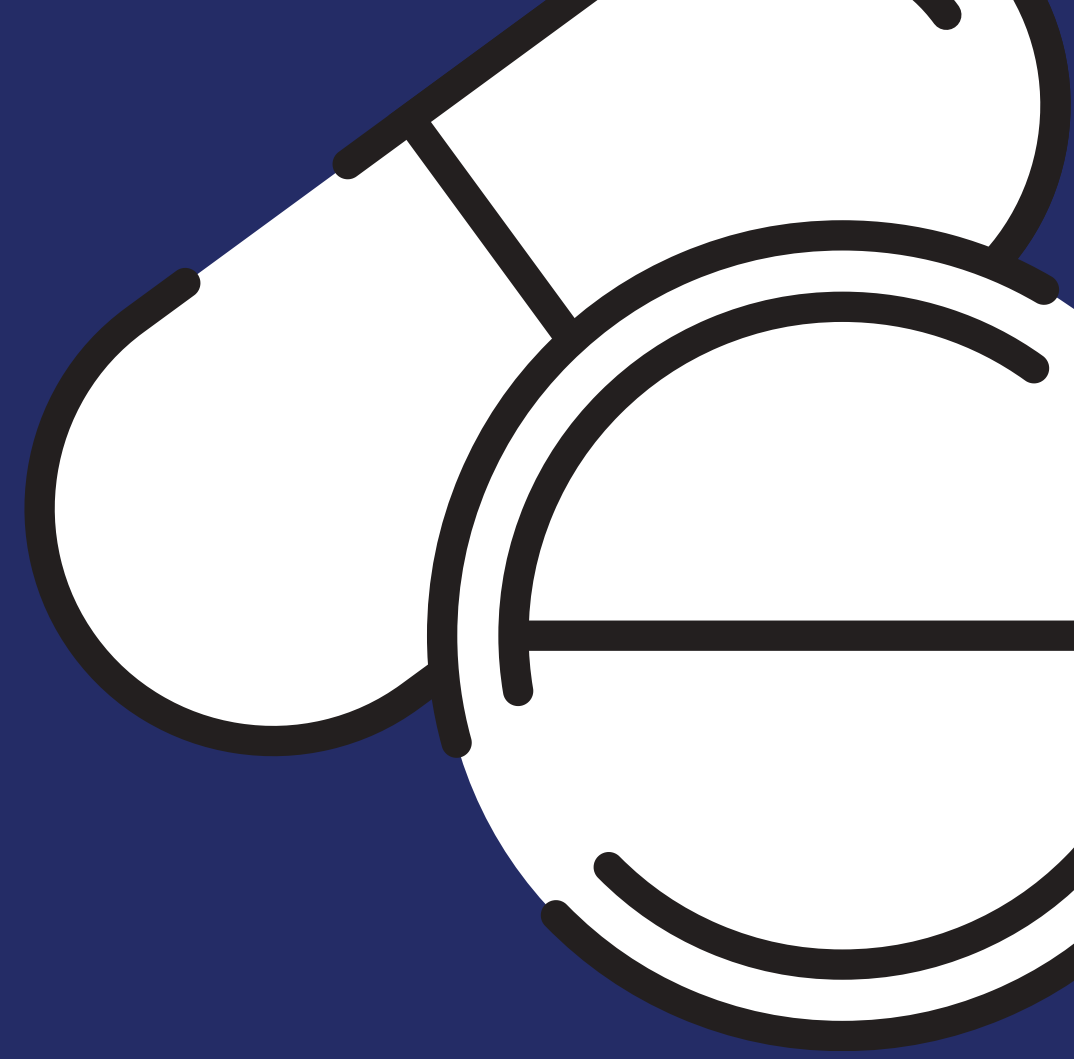
- **Online Projects**

- Podcasts about Medical Science
- Research Bank
- Paper Writing

- **Students' Initiative**

- Student Article Team
- Cinémedicine
- Drug & Disease of the Month
- The Student Blog
- Game night

AMR AWARENESS



Main purpose:

Raising awareness to the issue of antimicrobial resistance

Difficulty Level: Medium

FMOs which realized this project:
EMSA LMU Munich, Germany,
EMSA-Maltepe, Turkey

AMR is one of the most important issues in Medical Science nowadays. Especially medical students, who later in their professional careers are the ones prescribing antibiotics, should be aware of the implications.

There are plenty of options on how to inform fellow students or the general public about the problem - from handing out leaflets to organizing a workshop.

Many local EMSA organizations chose to launch a lecture on AMR, preferably given by a professor of public health or microbiology. This event highlights the most important aspects of the topic and its relevance for our future. It can be given to medical students and anyone who is interested. Even though AMR should also be a part of the medical curriculum of every university, this ensures everyone has the opportunity to learn about it and to deepen their interest and knowledge on the issue in an environment that is less tense than a classroom.



To make this event a success and attract as many people as possible, these can be useful tips:

1. Ask your faculty for help in promoting the project,
2. Look for sponsors to possibly provide free drinks and snacks,
3. Find several professors that can hold a short presentation on how AMR resistance is affecting their field,
4. Include a question session and/or discussion round at the end.

Note:

Organizing a lecture on a topic with high relevance for Medical students is not only limited to AMR. Every professor can teach students about new scientific developments and “fun facts” of their field.



Research Awareness Campaign


Main Purpose: To raise awareness about the importance of knowing a research process and its methodology for medical students.

Difficulty Level: Medium

FMOs Which Realized This Project: HeIMSIC
Greece

Since the **“research”** term is one of the key notions in the medical science pillar, building awareness about it is a necessity. Research awareness campaign focuses on this topic by running a one or two weeks social media campaign with the following goals:

1. To show the importance of medical research and its education throughout the medical education.
2. To bring medical students closer to basic concepts of Research Methodology and the types of Medical Research.
3. To encourage medical students to participate in research events actively and to inform people about their university's possible research projects.



In order to realize the points listed above, the FMO can start with publishing content about **research methodology** on their social media accounts and their websites to create curiosity for this project.

For instance, creating a **step-by-step guide** on their website about Research Methodology from theoretical definitions of Medical Research and its different types to how to construct a Research Protocol, Research Ethics and Publication Processes. In every step, using **external sources** such as infographics, articles, videos or interactive applications might be useful to give additional information about the research process and its implementations for the people who would like to learn more.

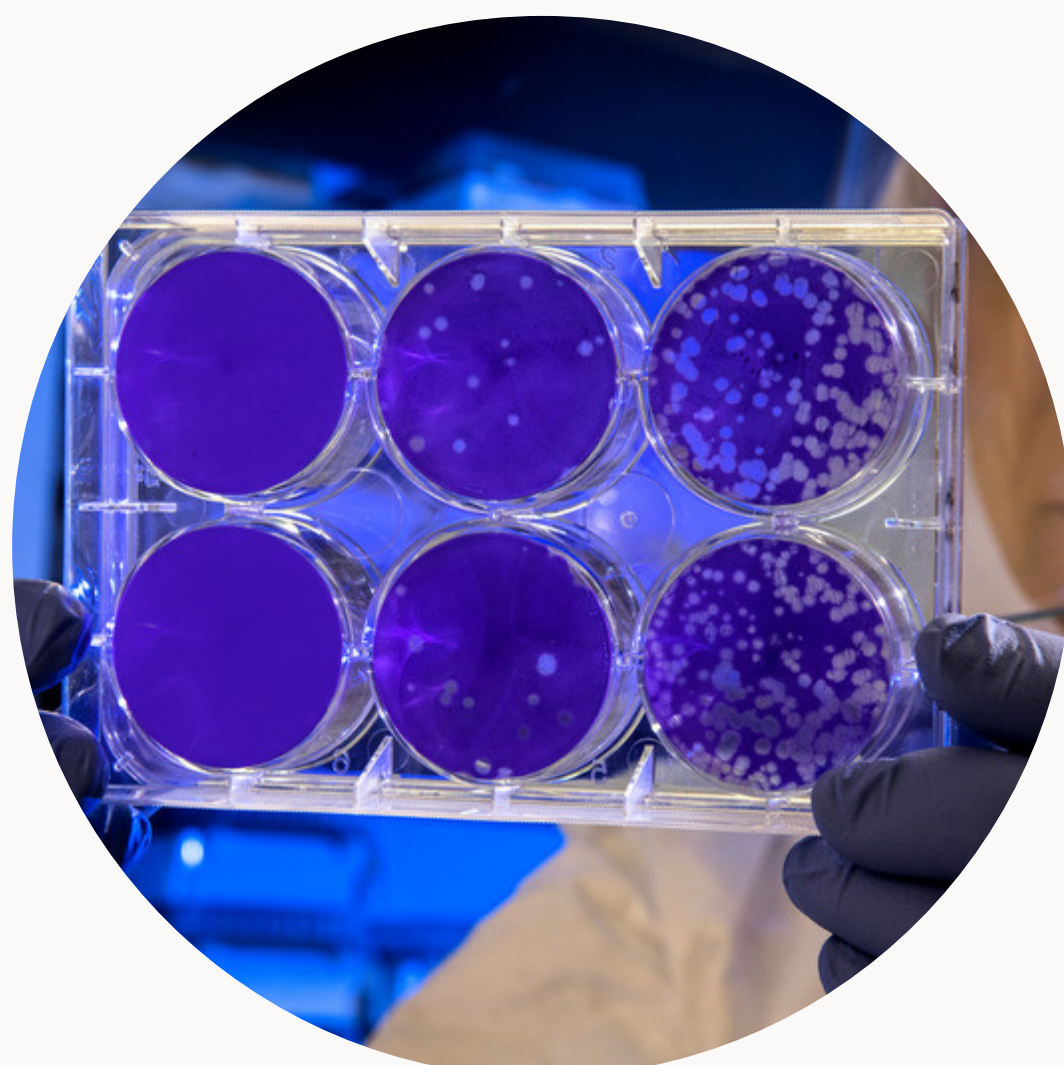
Pursuing **local partnerships** about this project can increase the projects' visibility at the hands of more people and can make the project more accessible. A partnership with universities' research centers such as libraries and local researchers can provide a more effective learning process for participants.

Therefore, initiating this guides' **social media promotion** also matters to create a recognition about the project. Besides the guide, sharing posts about the interesting facts about research or keystones of the methodology can be shown in an attractive way by designing social media posts.

Also; during the project, **quizzes and extra questions** to think about can be given to test participants' knowledge and enhance the interaction between the knowledge provider and its receiver. In this way, people can understand how much they perceived the topic of research in the light of this project.

And finally, at the end of this project the outcomes can be **published** by the FMO with access to all participants in order to show them how much information is shared and how much impact has been created via this campaign. With the outcomes, a complete guide with more educational resources, MOOCs and the results of a survey focusing on Medical Students which was set to determine whether Medical Students consider Medical Research an important aspect of their studies and which barriers they face in their country when it comes to research involvement.

Note: This project can be done more easily on a national level



Café Scientifique

Main purpose:

Learning about new research developments, understanding research papers & presenting scientific information to a group

FMOs which realized this project: EMSA-Istanbul, Turkey

Difficulty level: Easy

The Café Scientifique gives its participants the chance to learn about new developments in medical science in a non-academic setting. Instead, the monthly group's meeting typically takes place in a café but also gathering in a bar, restaurant or park is possible.

There are different options how to organize these meetings:

1. A scientist is invited to talk about his or her work. However, the presentation is supposed to be informal and short (15-20min) rather than a big planned-out presentation that uses presentation software. This enhances the friendly and informal atmosphere and makes the scientist more approachable. The group size can vary from 5-20 students.

• Café •



2. Another option is that students prepare the topic that is going to be discussed. Either one student presents a topic alone or all participants look at different aspects of the same topic and have mini presentations about their particular part. Possible topics could be e.g. a specific disease and its new treatment options. In this case, a couple of students present the basics whereas the rest talks about recently published research papers on the chosen topic. Again, the group size can vary. However, in the format where everyone gives a short presentation, the group should not be bigger than 8-10 students.

After presenting the research, the group goes on to ask questions and has a fruitful discussion that is moderated by the FMO's Medical Science Director.

These meetings usually take place once a month. The place to meet and participants can change each month or stay the same depending on the group's preference.





RESEARCH & MEDICINE

Main Purpose: To introduce scientific research to students, enabling students to understand research processes and increasing participation in scientific projects.

FMOs Which Realized This

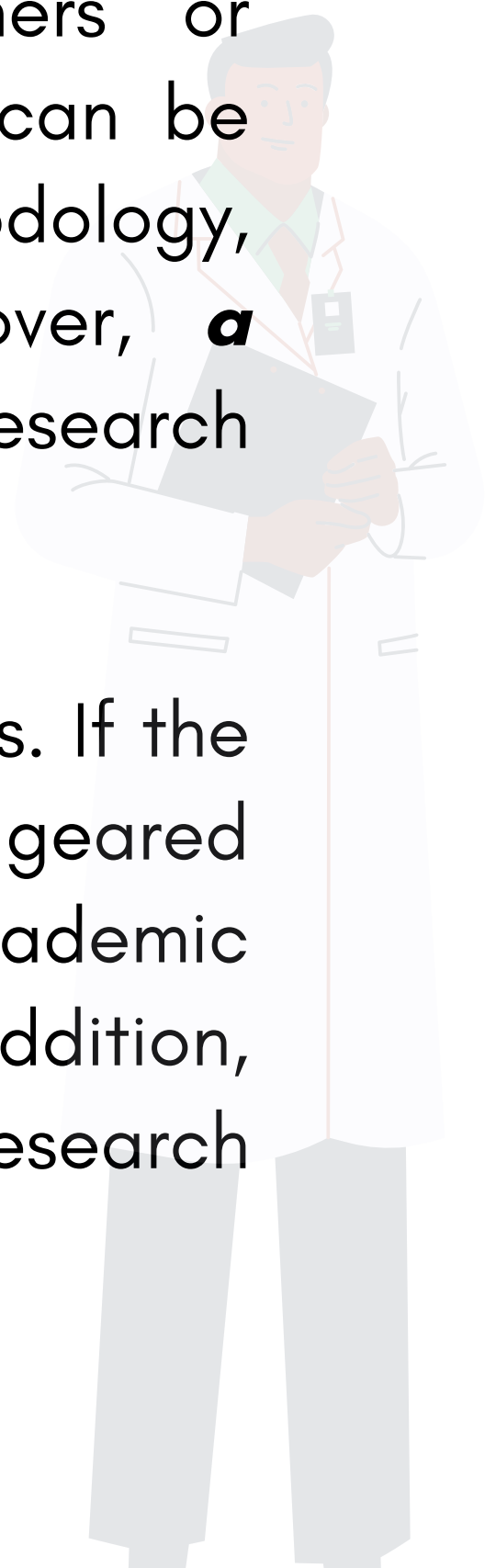
Difficulty Level: Hard

Project:

HelMSIC Greece, EMSA-Budapest
Hungary

This project is a **one-day research seminar** with lectures and hands-on workshops, organized either by peer teachers or professors, to teach students more about research. They can be trained on how to start a research project, research methodology, bioethics, biostatistics and many similar topics. Moreover, **a Scientific Fair can be included** that is dedicated to Research Opportunities provided by the University.

The seminars can be held after or before the semester begins. If the number of participants is limited, seminar attendance can be geared towards early grades, so that the information directed to academic research can be used **throughout medical education**. In addition, medical students in higher grades, who are doing scientific research can be invited to seminars or they can **mentor** other students.



GETTING TO KNOW RESEARCH

Main purpose: Learning about Medical Research & introducing the career in research by organizing tours to research centers.

Difficulty Level: Easy

Since research is one of the most important topics in medical sciences, it is **crucial** for students who want to pursue a career in medicine, to get to know the research environment. Regarding this issue, the project may help medical students to **observe research centers** by organising a tour for them.

Universities usually have an associated Research Centre. There, students can observe the research and be introduced to the research tools. They get to know the research opportunities and have **a chance to make themselves familiar** with the main area where scientific developments occur.

Furthermore, by observing the research centers, students' interest in **various scientific fields** may increase.



First way to meet the students with research centers is ***reaching out to a professor*** who is working there and asking if he or she could organize a tour for a small group of people around the centre. Students ***have a glance at*** the work of different research groups , provided that they follow the rules.

Assuming they know the possibilities, ***keeping in touch*** with the universities' student affairs offices can help to organize a tour. They are able to plan a time schedule and communicate with professors and researchers.



PODCASTS ABOUT MEDICAL SCIENCE

Main Purpose: To gain insight into the work lives of researchers & learn about new developments in medical science.

Difficulty level: Hard

FMOs Which Realized This Project: EMSA Turkey

Podcasts are **the contemporary way** of gathering information while walking, traveling, or drinking a cup of coffee. Therefore, integrating

medical science into our everyday life is **more possible** by recording podcasts than press-media, as this project aims.

The process of this project starts with the decision on the participants of the podcasts, who can be the best choice for the audience? Mostly, the **authorities of medical science and intellectuals** about the methodologies from all corners of the world are suitable for recording; this project gives a chance of

gathering information from everywhere **with a simple voice recording.**



After deciding, the meetings can be arranged via email, and conducted on any communication medium due to its recording function.

The most challenging part of the project can be **preparing the questions** for the interview. Questions must be comprehensive as they ought to include the interviewee's daily work life, career path and current research focus. But these questions must not be too private to answer.



Afterwards, with the gathered recordings, editing and uploading period starts. On any video editing tool, this project can be developed by getting rid of the video and cutting the voiceovers. After getting a clean voice recording, these **can be uploaded to any podcast medium** like Spotify, Soundcloud, or Apple Podcasts with proper permissions.

By doing that, a more **comprehensive library of medical science can be created** on different platforms. However, conducting this project comes with different levels of difficulties, because of the technical issues. So, this project is preferably more suitable for national level than FMO level.

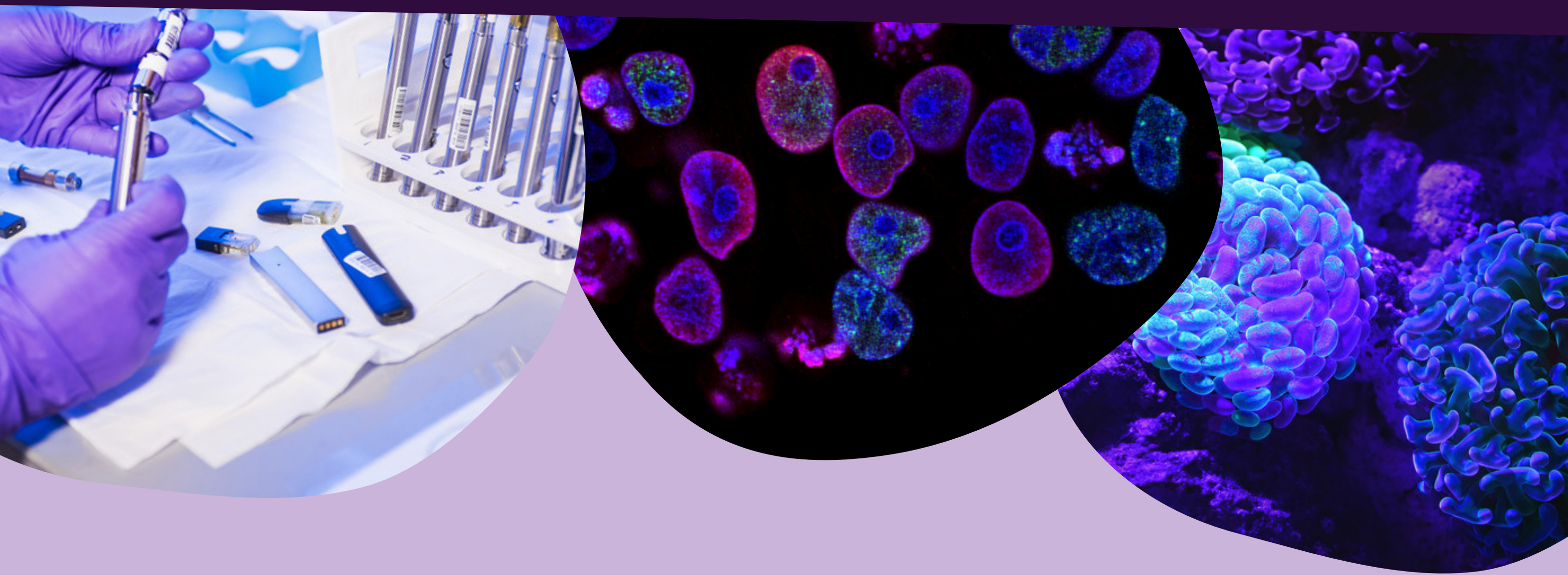
Research Bank

Main purpose: Finding research internships and projects.

FMOs which realized this project:

EMSA Porto, Portugal

Difficulty level: Medium



The Research Bank is a website or subsection of the local EMSA FMO website where medical students can find opportunities to experience research up close.

A huge part of this project is reaching out to professors and scientists at your university or at associated research institutes. The projects for students can vary from one-day observations or longer internships to even possibly job offers, depending on the professors' preferences.



This project helps creating a link between medical education and medical research which often is not sufficiently covered in the medical curriculum. Medical Students interested in going into research can gain a first-hand experience on how the daily life of a scientist working in a laboratory looks like.

Besides the detailed description of the project and contact information of the person responsible, the website can also have a comment or blog section where students can share their experiences and motivate others to apply for projects. It is important to always keep the website's information updated and add more and more projects over the years.

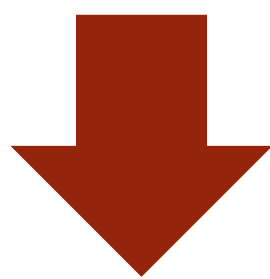


Writing a Research Paper

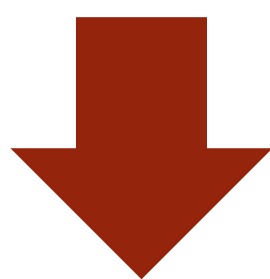
Main purpose: Students can improve their academic skills.

Difficulty level: Hard

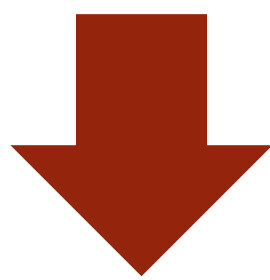
Choose a Topic



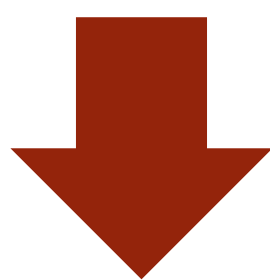
Write a Working Thesis Statement



Do Research on Your Topic



Make a Good Outline



Create the First Draft



Student Article Team

Main purpose: Learning about a topic & enhance writing skills by publishing an article about it.

Difficulty level: Easy

FMOs which realized this project:

EMSA Istanbul, Turkey

This project is entirely organized by students that choose a specific topic they are all interested in and **write an article** about it.

The group should preferably have **4-6 members**. At the first meeting, they decide on **the topic** and who is looking at **which aspect**. Then, everyone researches as much about their part as possible and eventually presents the most important findings to the others so that eventually everyone is an expert on all the angles of the topic. In the end, the group writes an article that they try to **submit to a magazine**.

The chosen topic can be anything that is somehow related to Medical Science, e.g. writing a scientific review article about the correlation between ***love and neurobiology***. Another option would be to write about a world health day that is coming up and consider many different perspectives such as ***clinical, social and psychological aspects***. Hence, this project is also a perfect opportunity to start an ***interpillar workgroup***.

The group can try to publish their work in various places. Besides reaching out to well-known magazines and websites, they can contact the local students' newspaper, people responsible for the university website and send it to EuroMeds to be included in the next issue. Moreover, they can also prepare a brochure and distribute it across campus, especially when they chose to write about a world health day to raise awareness for the subject.

While this project is a fun way to learn about a Medical Science related topic, there can be some challenges. The local Medical Science Director (or a substitute) has to make sure everyone is involved and contributes to writing the final article. Moreover, scientific writing standards have to be met, e.g. using correct citations. However for this very reason, this project creates a great opportunity for students to not only learn about a new topic but also improve their writing skills.

Cinémedicine



Main Purpose: To extend students' perception about medical topics beyond textbooks, creating an informal area to discuss topics and constructing bonds between medical students.

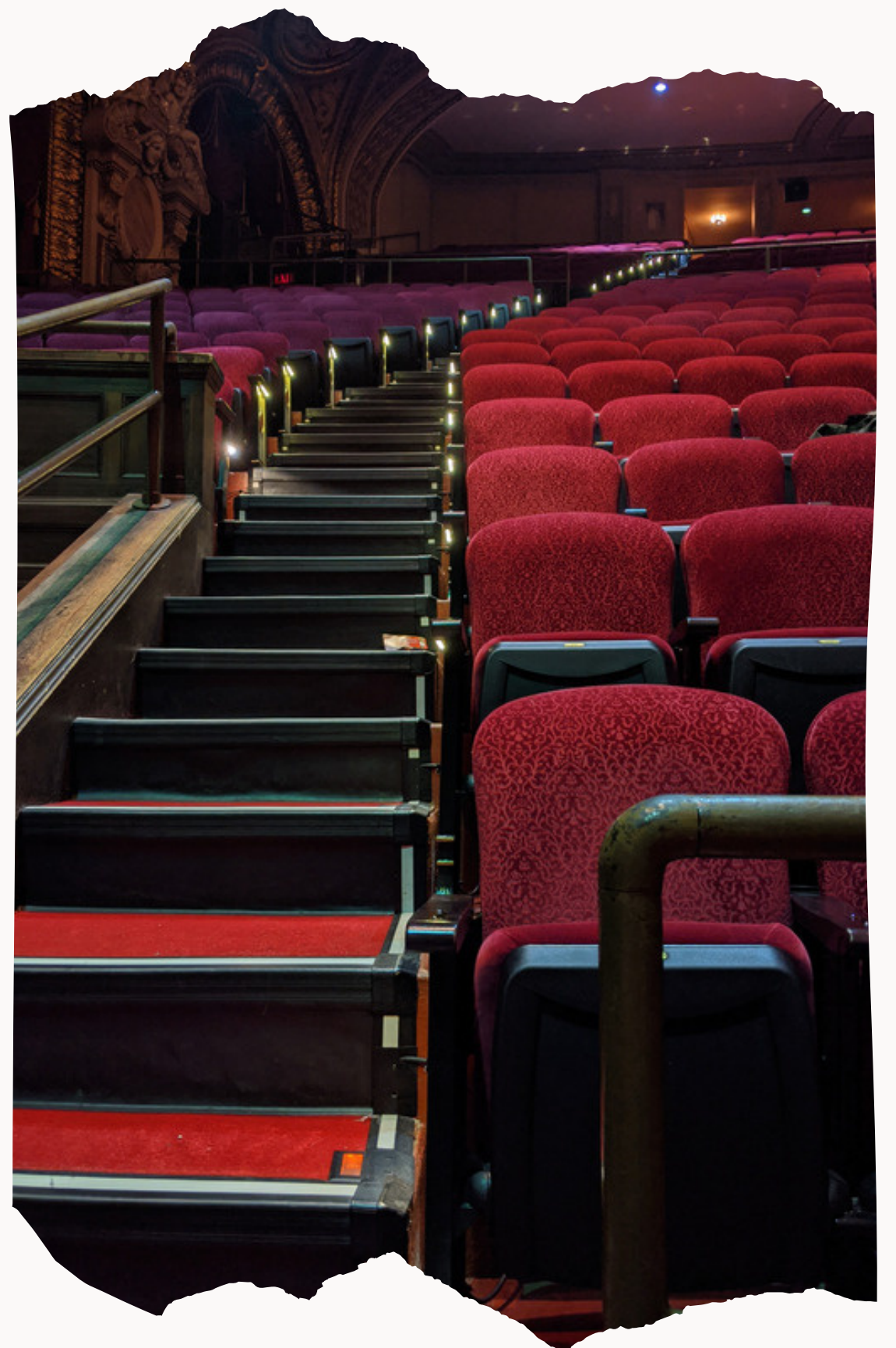
Difficulty Level: Easy

Watching a fun film together in class combines the experience of an **informal learning process** and creating a more meaningful bond with other students. This project aims to carry students' vision beyond textbooks and make their knowledge more **connected to everyday life** by the medium of cinema while students socialize and get acquainted with their ideas in a more comprehensive way.




It also provides the opportunity to **learn via observing movies** and discussing the scientific side of the diseases and all the concepts that are highly associated with medicine in the movies after watching.

However, it is important to bear in mind that not all students are keeping pace with the knowledge that is learned in class. To create overarching situations that all students can participate in, more general movies can be chosen that can eventually be analyzed in a medical way.



Another possibility to ensure that everyone is on the same level is having a **short presentation** about the main medical topic (max. 10 min) by one or two students before watching the movie. Also, at the end the participants can write a review about the topic discussed if they really enjoyed it.





Here is **a watchlist** for this project to provide a starting point:

1. House, M.D. (2004-2012) – Dr. House, an asocial and creative physician who does not like regular hospital rules conflicts his assistants with his controversial diagnoses.

2. Gattaca (1997) – Vincent, who experiences genetic discrimination in a dystopian future where most individuals are genetically selected, dreams about going to space and therefore pretends to be someone else.

3. Sicko (2017) – A documentary that discusses the different health policies in the world.

4. The Diving Bell and The Butterfly (2007) – A true story of a woman who suffered from a stroke and only communicates with her left eye.

5. The Beautiful Mind (2002) – John Nash, an unsociable mathematical genius, accepts a secret job as a cryptograph and his life turns into a nightmare.

6. Patch Adams (1998) – The story of a doctor who tries to cure illnesses with humour.

DRUG & DISEASE OF THE MONTH

Main Purpose: Keeping abreast of pharmacological data in a more attractive way and creating a curiosity about diseases that are not well-known.

Difficulty Level: Easy

Pharmacology is one of the most significant aspects of medical education that medical students will need in their entire career. To understand pharmacology, a medical student must **know the drugs by heart** and it also is a necessity for understanding how drugs work and why they are given. This project **proposes a much more fun way** of memorizing drug types with their most important aspects.

Moreover, diseases have a complicated relationship with drugs. A medical doctor's duty is learning how to prevent, diagnose, treat illness **in high-stakes situations**, and figuring out how drugs behave against this disease process.





For this project, at the beginning of the semester, a small working group is created under the medical science pillar to prepare a document about **interesting drugs and a disease** encountered in the medical curriculum with very brief information about each. At the beginning of each month, the **drug & disease** of the month can be voted for in FMO or in this small working group.

After the selection of the drug & disease, every student that is interested in medical science can gather more information and **interesting facts** about drug & disease and all the data that is collected can be combined in a one presentation and additional infographics and social media posts to increase awareness about this project.





THE STUDENT BLOG

Main Purpose: To construct a space for developing personal, academic and professional communication among medical students by providing a formal or informal discussion sphere.

Difficulty Level: Hard

Blogging proposes a more interactive way of thinking and an informal/formal discussion sphere. Also, it **constructs bridges between** the **traditional way** of medical education such as textbooks or laboratories and **digital ways** of learning. Seeing that it covers different aspects of education, it can be used in a way to enhance **the process of gaining knowledge** about medical science.



The student blog project gives numerous situations to **learn, think, and share**. It can include tools for *creative discussions, infographics, quizzes* for fun and *learning*, as well as *writings* and elements from art and literature to develop a more **multidisciplinary way of understanding**.

Owing to this potential, a blog for medical students enables students to **engage their ideas** in conversations. Also it can be embedded in university's websites with a news feed. There are many tools for creating a teaching and aesthetically pleasing blog to catalyze the technical process. FMO can also **get professional help** for the development of a blog and creating the designs.

But it is important to know that most students don't have experience writing for blogs for academic purposes, so students will need to look over some university blogs or ask for help that can be given by academic writing instructors. **Here are some of the universities' blogs to take a look at and gather inspiration from:**

University of Oxford: <https://www.ox.ac.uk/news/science-blog>

Note: This project can be done more easily on a national level.

GAME NIGHT

Main purpose: Games can teach medical students useful research skills in a fun way

Difficulty Level: Easy

Games are fun right ? Games with Dictionaries helps students improve their developing, searching and finding skills as well as **reasoning and verbal cognitive skills.**

Secondly, it also helps them develop **Vocabulary and Medical Terminology.**

1. Word Hunt - Search the proper term for the given definition from the dictionary or from your memory

Example: The MS director gives the definition - "The chemical processes in living things that changes food, etc. into energy and materials for growth" and the person should give the term for this which is metabolism for this.



2. Dictionary Dig - To play this game, the medical science team gives a series of clues. As students hear the clues, they look for the word in the dictionary until they have narrowed it down to just one. For Example: "I begin with the third letter of the alphabet. My second letter is an "r." I am two syllables long. I come before "drug" in the dictionary. My last letter is "t.""

3. Guess the blocks - You will be given an incomplete word and the ask for people to search. For Example: Give the word H_A_T instead of Heart / B_A_N instead of Brain and they have to find out for the word.

4. Research Game - The Game of Research is a teaching activity by the University of Tennessee that was inspired by "The Game Of Life" which is a board game. It has rewards for each right step in research and a penalty for each wrong step in research.



QR Code to game instructions and materials.

SCIENTIFIC
APPROACH

RESEARCH IOI

Definitions for absolute beginners

Research:

Creative and systematic study of a subject in order to discover facts or principles and to increase the stock of knowledge.



Paradigm:

Pattern, a theory or group of ideas about how something should be done, made or thought about.

Research Paradigm:

The set of common beliefs and agreements shared between scientists about how problems should be approached and understood and how a research should be conducted.

Research Steps:

Steps that outline a simple, effective and systematic strategy for research process.

“What is Scientific Thinking?”

The basis of scientific thinking is critical thought. Scientific thinking refers to the “content” and “reasoning processes” of science. The content of science involves reasoning about scientific entities and processes such as force and magnetism whereas the reasoning processes focus on the procedures that permeate the field of science which include induction, experimental design, hypothesis testing and so on.

Scientific Thinking Cycles

Scientific thinking refers to the “content” and “reasoning processes” of science respectively. The content of science involves reasoning about scientific entities and processes such as force and magnetism whereas the second one focuses on the procedures that permeate the field of science which include induction, experimental design, hypothesis testing.

The basis of scientific thinking is critical thought.

1.

Individual Observation



Wider Research



Development and use of concepts



Trying them out



Better informed observation



2.

Observing

Scientists make observations and examine prior research



Forming Hypothesis

Scientists ask a question and try to explain observations



Testing Hypothesis

Scientists use Research Methods to support or reject the hypothesis



Analyzing Data

Scientists analyze their data to draw conclusions on their research



Evaluating Results & Conclusions

Scientists evaluate the data and compare it to that of other scientists

3.

Observation



Question



Hypothesis



Experiment



Analysis



Conclusion (cycle repeats itself)

“What is the Scientific Method?”

Research Methods

Research methods are the processes or techniques utilized in the collection of data for analysis in order to uncover new information or create better understanding of a topic. Different research methods use different tools for data collection.

Qualitative Research gathers data about lived experiences, behaviours and emotions. It enables researchers to gain a better understanding of complex concepts such as social interactions by interpreting events.

Quantitative Research gathers numerical data which can be ranked through statistical analysis. It is useful in uncovering patterns and making generalizations by answering questions such as ‘how many’, ‘how much’, ‘how often’ or ‘to what extent’.



Mixed Methods Research integrates both qualitative and quantitative methods providing a holistic approach.

Qualitative Techniques: Interviews, Focus Groups, Observation, Document analysis, Oral history

Quantitative Techniques: Surveys or questionnaires, Observation, Document screening, Experiments

Categorization

- 1) Qualitative or Quantitative
- 2) Primary or Secondary
- 3) Descriptive or Experimental
- 4) Statistic Analysis or Thematic Analysis
- 5) Basic, Clinical or Epidemiological Research
- 6) Interventional or Non-interventional





Ontology: *“What is reality?”*

Ontology is concerned with “being” or reality. It is the starting point of all research.

Epistemology: *“How do you know what you know is true?”*

Epistemology is concerned with the theory of knowledge, especially related to its methods, validation and the ways of gaining knowledge.

How “what is assumed to exist” can be known?

Methodology (and Research Methods) : *“How do you find it out?”*

-Methodology refers to the way through which researchers need to direct their research.

-Research methods refer to the more practical issues of choosing an appropriate research approach to answer a research question, and then designing instruments to generate data.

Axiology (Ethics) : *“What is the nature of values?”*

-Axiology refers to the ethical issues that need to be considered when planning a research proposal. It considers the philosophical approach to making right decisions.

Research Methodology

Research Methodology refers to how a researcher systematically designs a study to ensure valid and reliable results that address the research objectives:

- What data to collect
- Where to collect it from
- How to collect it
- How to analyse it

Steps to Conduct Research:

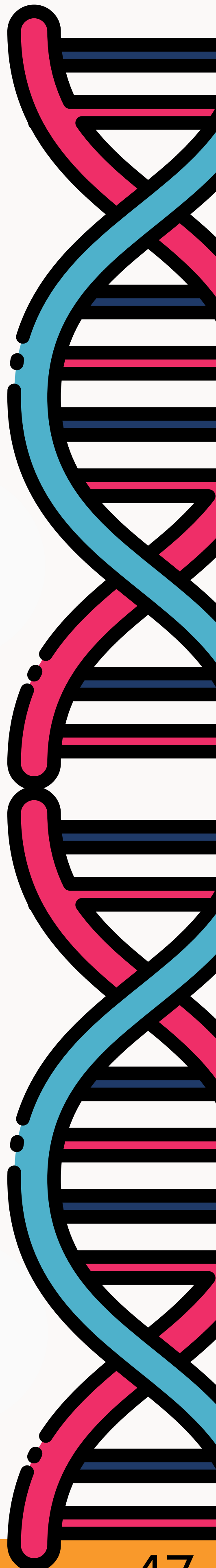
1. Define the Research Problem
2. Literature Review
3. Hypothesis
4. Research Design
5. Carry out Research Process
6. Research Results
7. Research Findings Analysis

Science Paradigms

A paradigm is a basic model and theoretical framework with assumptions about:

(main factors of paradigms)

- 1) Ontology
- 2) Epistemology
- 3) Methodology
- 4) Axiology



Paradigm Debate/ Different Paradigms

Positivism suggests that there is a certain knowledge, which can be measured and known, therefore it is more likely to use quantitative methods.

Subjectivism suggests that reality is what we perceive to be real and changes from person to person.

Criticalism suggests that reality and knowledge are both socially constructed and they are under constant internal influences.

Constructivism suggests that there is no single reality or truth, and therefore reality needs to be interpreted, and therefore constructivists are more likely to use qualitative methods to get those multiple realities.

Pragmatism suggests that reality is constantly renegotiated, debated, interpreted and even changed and therefore the best method to use is the one that solves the current problem.

There are two approaches used for collecting and analyzing data that each has different objectives and methods, and both are important for gaining different kinds of knowledge: qualitative research and quantitative research.

Quantitative research is expressed in numbers and graphs. It is used to test or confirm theories and assumptions. (Fixed and measurable reality)

Qualitative research is expressed in words and meanings. It is used to understand concepts, thoughts and experiences. (Dynamic and negotiated reality)

FINAL WORD

We really hope you enjoyed reading this booklet and that you will find it useful.

Should you have any questions or doubts, do not hesitate to contact us at:

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*May the wisdom and power
of science be with you!*



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