

Let the Brains begin!



IJSO 2020

17th International
Junior Science Olympiad

Frankfurt, Germany | Dec 2nd – 12th 2020

www.ijso2020.de



Olympic Games for the Brain – Enthusiasm for Science

Welcome to the 17th International Junior Science Olympiad!

We were proud when the IPN, the Leibniz Institute for Science and Mathematics Education in Kiel, was asked to host this competition because the international competition of the IJSO fits perfectly to the IPN and its efforts to promote young talents in science.

The IPN is one of the leading research institutes in Germany working in the field of teaching and learning science and mathematics. The institute is involved in several long-term research projects as well as international large-scale assessments, including PISA. The IPN's research goes beyond a subject-specific perspective and investigates general aspects of high-quality teaching using and developing state-of-the-art research methods. As a member of the Leibniz Association, the IPN is affiliated with 95 independent research institutes in Germany. Leibniz institutes focus

on highly relevant social, economic and ecological issues.

One of the IPN's research areas investigates conditions, characteristics, and effects of teaching and learning in mathematics and science. The focus is on the learning processes of children and adolescents as these processes influence competences, interests, and beliefs in science and mathematics. Furthermore, we investigate questions pertaining to the development of teachers' professional knowledge. The IPN develops new scientific approaches according to didactic and pedagogical principles and examines the effectiveness of these new concepts in school teaching. One focus of the institute's work is on issues relating to science communication and extracurricular learning, e.g., in museums or student laboratories. In addition to research, the IPN also

conducts many transfer activities closely related to its research. This is the reason why the IPN, supported by the Federal Ministry of Education and Research, organizes the national selection competitions for various (international) student competitions. The IPN has responsibility for the Biology Olympiad, the Chemistry Olympiad, the Physics Olympiad, the European Science Olympiad, the Federal Environment Competition and of course the selection competition for the International Junior Science Olympiad. It is, therefore, a very special honor for the IPN to host the international competition this year. We wish all participants an interesting, inspiring and successful time in Frankfurt!



Prof. Dr. Olaf Köller,
IPN Managing Director of Research

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Frankfurt am Main



Federal President
Frank-Walter Steinmeier
is the official patron of
the **IJSO2020**.

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Dear Members of the IJSO Family,

As the British author and scientist Charles Percy Snow once said, „Scientists have the future in their bones“. Indeed, the findings of natural science will determine our future. A good knowledge of biology, chemistry, physics and the environment provides us with the best possible basis for actively contributing to societal development and progress.

The world is changing rapidly and we are confronted with major challenges. Being a scientist means continuing to explore things from different perspectives, never being satisfied with what you know and understand. We want to see more young people adopting this view and taking a keen interest in the natural sciences. For many years, we have been working to make them aware of the world of science and what it has to offer. With its interdisciplinary profile, the International Junior Science Olympiad is of special importance in this respect as it addresses the under-15 age group.

We are therefore delighted to host the Olympiad in December 2020 and to welcome 300 bright young talents and their mentors from 50 participating nations around the globe. We want to provide a fair and challenging competition and help ensure that you enjoy your time in Germany. Make the most of this opportunity to meet people from all over the world who share your enthusiasm for science. We look forward to celebrating this big event with you, sharing the memorable experiences and inspiring encounters that only Olympiads are able to offer.

A handwritten signature in black ink that reads "Anja Karliczek".

Anja Karliczek
Member of the German Bundestag
Federal Minister of Education and Research

A Warm Welcome to Hessen!

The International Junior Science Olympiad (IJSO) will take place in Hessen from the 2nd to the 12th of December 2020. Hessen warmly welcomes students and their mentors from more than 50 countries from all over the world to join the 2020 Olympiad.

Our state has not only magnificent institutions of higher education but is also home to many highly competitive research facilities. We see the promotion of education, research and the sciences as the most important investment in our future.

The Hessen state government is aware of the significance of the Natural Sciences in the biographies of young people, ranging from their general education in schools to all aspects of their daily life. This is why



Volker Bouffier
Prime Minister of Hessen

Frankfurt, a city at the heart of the European Union, the largest city in Hessen and the fifth largest in Germany, is very honoured to host the 17th IJSO.

The International Junior Science Olympiad in Frankfurt is an educational event that will challenge, inspire and encourage talented students to develop their skills and scientific competencies in the Natural Sciences. It will also help students to reach out and find like-minded colleagues and friends from around the world. Last but not least, by joining the Olympiad students will have the chance to experience one of Europe's most international and vibrant cities. So, enjoy discovering what Frankfurt and Hessen have to offer! We wish you all the best and good luck.



Prof. Dr. R. Alexander Lorz
Hessian Minister of Education and Religious Affairs



Prof. Dr.
R. Alexander Lorz

Welcome to Germany! Welcome to Frankfurt!

Welcome to Germany – at the Heart of Europe

Lying between the Baltic and North Seas to the north, and the Alps, Lake Constance, and the High Rhine to the south, Germany is a naturally geographically diverse country which enjoys a moderate climate. In the summertime, in July, the average temperature is about 17.2 degrees Celsius, but there can be particularly hot periods as well, with around 28-30 degrees. During the IJSO2020, it will be winter in Germany where the average temperature is 0.9 degrees Celsius, so make sure to bring warm clothes!

Germany consists of 16 federal states and has 83 million inhabitants. It is a decentralised country, with Berlin being the capital and Frankfurt serving as its financial centre. The mix of exciting cities and stunning scenery fascinates and

delights many visitors. Contributing to this diversity are the surrounding neighbour countries; it shares its borders with nine other nations. This makes it an attractive travel destination for international visitors. Also, the living standards are very high. The 2016 United Nations' Human Development Index (HDI) puts Germany fourth out of a total of 188 countries.

Germany has a high international standing in research and sciences. In climate policy, for instance, it leads the way and is a pioneer in the development of renewable energies.

Welcome to “Mainhattan”

We would like to welcome you to the city of Frankfurt on the river Main! The metropolis Frankfurt is the largest city of the German federal state of Hessen with around 750,000 inhabitants, and it is located in the Rhine-Main region. The city is a dynamic and international commerce and trading centre with an impressive and unique skyline. Frankfurt is the largest financial centre in continental Europe; sometimes it is referred to as “Mainhattan” or “Bankfurt”.

Its central location within Germany and Europe makes Frankfurt a major air, rail, and road transport hub, which also makes it a favourable destination for both national and international trade fairs and conferences. Frankfurt Airport is one of the world's busiest international airports – measured by passenger traffic. It is less than 30 minutes from Frankfurt's main train station, one of the largest train stations in Germany. The city has a well-developed public transport system.

Where Modernity Meets Tradition

In Frankfurt, you can feel the pulse of innovation and development. Frankfurt is home to companies from the chemical, transportation, telecommunication and the energy industries. Located in Frankfurt-Höchst is the Industriepark Höchst, one of Germany's largest industrial parks with over 90 companies from the pharmaceutical, chemical and biotechnology industry, including Merck, Celanese, Clariant, BASF, and Siemens.



Frankfurt in Numbers

54.5 % of all apartments are single-person studios.

57 times until 2017, the Peace Prize of the German Book Trade was awarded.

337.5 m is the height of the Tower of Europe. It is the highest building in Frankfurt and country-wise the second highest.

534 years ago books were traded for the first time at the Frankfurt Book Fair.

1,758.4 hours is the average number of hours the sun shines per year.

197,044 members are in Frankfurt's local sports clubs.

5,934,778 visitors were counted in Frankfurt in 2018; an increase of 5.6% compared to 2017.

20,672,807 is the number of media files owned by the German National Library (2018).

6.78 TBit/s run through the world's largest internet hub here.

Frankfurt's architecture ranks amongst the most modern in Europe. As for viewing unique skyscrapers, there are numerous options to choose from. You can visit the rooftop of the famous Main Tower to overlook the city from 200 meters above the streets. You can also view the skyline from street level, from the pedestrian bridge Eiserner Steg (Iron Footbridge).

Moreover, Frankfurt is a very popular shopping city, offering a diverse range of products and services for everyone. Stroll through Frankfurt's premier shopping street Zeil or stop by the new indoor shopping centre Skyline Plaza.

Frankfurt also has a warm and cosy side and is a great city for sightseeing walks. The vast majority of its downtown destinations may be reached on foot. You can, for instance, take a break at one of the traditional apple wine pubs in Old

Sachsenhausen, or walk along the Museumsufer, a landscape of 20 museums lined up on both banks of the river Main: the cultural mile of Frankfurt. At the centre of this cultural mile, you will find the famous historic art museum Städel, but there are museums to suit everyone's taste. Within walking distance of the museums you will find the Römerberg and the Römer, Frankfurt's distinctive townhall; St. Paul's Church, the cradle of German democracy, and other famous historical buildings. You can visit the Goethe-Haus, the birthplace and family home of the world-famous poet and writer Johann Wolfgang von Goethe. He wrote some of his early works there, including "The Sorrows of the Young Werther", and parts of "Faust".

"TO ME, THE IJSO MEANS COLLECTING MANY EXPERIENCES, GETTING TO KNOW OTHER PEOPLE AND CULTURES, AND MAKING FRIENDS. SOME OF THESE FRIENDSHIPS STILL EXIST TODAY."

Friedrich Fuchs, IJSO participant 2014

A City for Scientists

Frankfurt has a university named after its most famous son, the Goethe University; the main building is located in the Westend district. The university has been influential in medicine and the natural sciences and has affiliations with Nobel Prize winners including Max von Laue and Max Born. In the Westend, you can also visit the Senckenberg Nature Museum, the second largest natural history museum in Germany, with its impressive exhibition of dinosaurs. Within walking distance of the Senckenberg Nature Museum is the Palmengarten, Hessen's largest botanical garden, where you can discover both native and tropical plants outdoors and in greenhouses. Also, in the eastern part of Frankfurt, you will find Frankfurt Zoo. It features over 4,500 animals and over 500 species. The famous researcher and zoologist Bernhard Grzimek was director of the Zoo from 1945 until 1974.

When it's Cold Outside

Germany is famous for its traditional and cosy Christmas markets, which usually open at the end of November and run through the whole of December until Christmas Eve. These are festive street markets offering food, drink, arts and craft work, and seasonal items from open-air stalls. The Frankfurt Christmas Market is one of the largest and oldest in Germany. It dates back to 1393 and today attracts about 3 million visitors annually. It takes place in the city centre around Römerberg with approximately 200 stalls. It is a must-see at this time of the year. Make sure to try some "Glühwein", which is the German version of mulled wine, and taste some of the local food offered in the streets, such as the traditional bread called "Christstollen".



The IJSO – an Open-minded International Competition

Founded in Jakarta in 2004, the IJSO is an educational competition in the natural sciences which takes place each year in December. 50 countries around the globe set up national qualifiers to send their best six students to take part in this event. But what does IJSO stand for?

The **I** stands for International – meeting people from around the globe, getting together not only to share knowledge but also to encounter other cultures, leaving a lasting impact on everyone taking part. Borders lose their significance as participants discuss and complete tasks. Science becomes the universal language, bringing tolerance and peace to the world.

The **J** stands for Junior – the most important element of this event! Only students from member countries who are 15 or younger can participate. The IJSO was founded to get students involved in the natural sciences at an early age to continuously support them from the very start of their educational careers.

The **S** stands for Science – the contest triggers the passion to explore! The young competitors have to cope with theoretical and experimental tasks in biology, chemistry, and physics – both individually and in teams – applying their skills to scientific concepts in specific settings across all fields. Problem-solving prowess is a must!

The **O** stands for Olympiad – alluding to the Olympic Spirit and a fair competition. Friendship, mutual understanding and striving for a better world are the common goals. The IJSO aims to inspire the youth of the world to be their very best, through interactive challenges both educational and entertaining.

The International Junior Science Olympiad is a great opportunity to excel, to grow and perform, to gain self-confidence and return home with new knowledge, expanded horizons and not least, life-long friendships with fellow IJSO participants.

The National IJSO in Germany – Making Science Accessible

Every year since 2004, student teams from Germany have taken part in the IJSO and brought home medals. In 2008, the Federal Ministry of Education and Research officially assigned the Leibniz Institute for Science and Mathematics Education to set up a national, four-stage preselection competition for the IJSO, tying in all 16 federal states. This turned out to be the initial crucial milestone for the IJSO Germany on its road to success.

The IJSO Germany reaches out to children at an early age to provide long-lasting guidance and support. Via simple experiments that demonstrate how natural sciences are a part of everyday life, the students can engage deeply with scientific phenomena and questions. These tasks are designed to instill a sense of achievement in everyone participating in the competition, even at the first level. The IJSO engages young talent from Years 5 to 7 at an accessible level and

strives to encourage teachers to embed the IJSO in their science timetables and regular school life.

Currently, around 5,000 students aged between 9 and 15 register for the national qualifiers, which start on November 1st of every year. At the first stage, they carry out experiments which they can complete in teams of three students. At stage two and three they are faced with the challenge of theoretical exams combining biology, chemistry, and physics. By mid September the best-scoring 39 students are invited to the German finals, a one-week qualifying seminar including lab work.

This event culminates in a festive award ceremony open to the public where the six members of the German IJSO national team are officially nominated. Those six lucky and clever ones can look forward to 11 exciting days at the olympic contest in December, sharing their passion for science with 300 like-minded from all around the globe.

IJSO Aims

To promote and reward the pursuit of excellence in scientific endeavour

To challenge, stimulate, and encourage gifted students to further develop their talents in natural sciences

To create friendships and relationships among students around the world from an early age

IJSO Objectives

To stimulate the active interest of students in the natural sciences

To promote their careers as scientists

To enhance and develop international contacts in the natural sciences

To promote future scientific collaboration

To encourage the formation of friendships within the scientific community

To offer the opportunity to compare the syllabi and educational trends in science education within the participating countries



Dear Guests,

Since 2004 more than 30,000 German students involved themselves in the IJSO, many of whom are pursuing academic careers in the natural sciences by now. Quite a few among them study in countries all over the world, in part thanks to the IJSO.

We are grateful to the many IJSO host countries that gave our students and mentors the opportunity to experience countless new places and meet people from around the globe in Africa, America, Asia, and in Europe. They made friends all over the world and still have a burning passion for science.

Now the time has come to return the favour. We are proud to announce that the 17th International Science Olympiad will be held in Germany. As the Chair of the IJSO2020, it is my great pleasure to

invite you, the IJSO family, to Frankfurt am Main. I can assure you that Germany will leverage all its efforts and skills to host a fair and enjoyable competition. We are looking forward to showing you around and sharing with you many exciting, touching, and magical moments.

A warm welcome to Frankfurt am Main!

A handwritten signature in blue ink that reads "Heide Peters".

PD Dr. Heide Peters
Chair of IJSO2020 Germany

The 17th International Junior Science Olympiad IJSO2020 Germany



Shaping the Future

Germany is looking forward to hosting the International Junior Science Olympiad for the first time!

From 2 to 12 December 2020, the Main metropolis Frankfurt will transform into a research stronghold for young talents. During those 11 days, 300 young people from around 50 nations will compete for medals in biology, chemistry, and physics. Both, the students and their 200 accompanying mentors will delve into an atmosphere of internationality and knowledge exchange during their stay in Frankfurt. Meeting each other, working together, discovering together, and watching sights together will create everlasting connections.

Exams and Leisure

The backbone and central element of the IJSO2020 are the three exam days.

About 30 experts including award winners of previous science olympiads nationwide, who are teaching natural sciences at universities or high schools, prepare two challenging theoretical tests and one experimental test. Presented in English by those members of the scientific committee, the tests will be diligently discussed and translated into the students' mother tongues by the accompanying mentors. Afterwards, the students' papers will be evaluated and ranked by the scientific committee and associated experts. The IJSO2020 is therein supported by the Goethe University Frankfurt.

On days with no exams, the students can relax, and on days with exams, the mentors can relax. A leisure programme organised by the host country, designed for participants to get to know the country and its people, is also a major part of the competition week. This includes visiting the famous Senckenberg Nature Museum and of course, a trip to the Christmas Market.

"I MET SEVERAL PEOPLE, BOTH STUDENTS AND ADULTS, WHO INSPIRED ME THROUGH THEIR INTEREST, THEIR MOTIVATION AND THEIR BELIEF IN THE MEANING OF SCIENCE."

Florian Knebel, IJSO participant 2015

Festive Highlights

Special moments for everyone are the annually reoccurring IJSO-opening ceremony, the cultural night and the closing ceremony. Those events cast a light of glamour and sparkle on the IJSO. It is a pleasure watching everyone dressing up and getting excited. The opening ceremony is the starting point of a week filled with excitement, and the cultural night sets an example for intercultural understanding and friendship. The closing ceremony is the most prominent party, where the winners are announced and receive their awards. Guests from the diplomatic corps and from the fields of politics, business, science, and culture are all expected to attend this special occasion.

VIPs on Board!

Federal President Frank Walter Steinmeier is the official patron of the IJSO2020. Furthermore, we are pleased to introduce our official ambassador, Prof. Dr. Antje Boetius, who is native to Frankfurt. She is a German marine biologist and professor of geomicrobiology at the Max Planck Institute for Marine Microbiology, University of Bremen. Antje Boetius is the Chairwoman of the Steering Committee of Science in Dialogue and also heads the famous Alfred Wegener Institute in Bremerhaven. In the public debate on the climate crisis, Boetius advocates a significant intensification of climate protection. In 2018, she was honoured with the prestigious German Environmental Award.

Schedule, Students

| | |
|--------|---------------------|
| Day 1 | Arrivals |
| Day 2 | Opening Ceremony |
| Day 3 | Exam Instruction |
| Day 4 | Exam 1 |
| Day 5 | Tour / Leisure Time |
| Day 6 | Exam 2 |
| Day 7 | Tour / Leisure Time |
| Day 8 | Exam 3 |
| Day 9 | Tour / Leisure Time |
| Day 10 | Closing Ceremony |
| Day 11 | Departure |

Schedule, Mentors

| | |
|--------|------------------------------|
| Day 1 | Arrivals |
| Day 2 | Opening Ceremony |
| Day 3 | Discussion and Translation 1 |
| Day 4 | Tour / Leisure Time |
| Day 5 | Discussion and Translation 2 |
| Day 6 | Tour / Leisure Time |
| Day 7 | Discussion and Translation 3 |
| Day 8 | Tour / Leisure Time |
| Day 9 | Moderation |
| Day 10 | Closing Ceremony |
| Day 11 | Departure |

Dear Members of the IJSO Family,

Children intuitively grasp that discovering the world is an exciting and important venture. When I was a child, I loved the stories my grandfather would tell about his life at sea. My parents taught me the sea from the shore. I read pirate stories and Jules Verne's "20,000 leagues under the sea", watched TV documentaries about marine life. That was when I realized: When I grow up, I want to go even deeper and explore the ocean all the way to the bottom.

My dream has come true: I stand before you as a marine explorer by heart and soul. Nowadays, I am driven by another dream: that of a world with healthy seas and diversity of species. To achieve this goal, we require all knowledge conceivable and a concerted resolve to change course.

When I listen to the youth of today who demands a good future for itself and the earth, I cannot help but think that they must have paid very good attention in school. They are capable of drawing the connection between our actions and the state of our planet today. That is why the early promotion of and networking between young talents in the natural sciences is so very important – they are the ones that can help shape our future.



Prof. Dr. Antje Boetius
Director of the Alfred Wegener Institute
Helmholtz Centre for Polar and Marine Research





Fotograf: Johannes Haas

The well-known and award-winning television presenter, author, screenwriter, and actor Ralph Caspers will host the opening as well as the closing ceremony in Frankfurt. He is known for many high-quality science and knowledge shows both for children and adults, which are produced for public service broadcasters such as the WDR. Ralph Caspers was the presenter of the children's TV show „Wissen macht Ah!“ (roughly: The sound of knowledge is Ah!), which has become a cult show not only among younger audiences.

Dear Olympians and IJSO2020 Enthusiasts,

Overcoming borders, connecting cultures and creating enthusiasm for the natural sciences. And never being shy to ask questions. That's what I do. This is also what the IJSO does and I am more than happy to contribute to the event in 2020.

My own career has allowed many places to become part of my world. I have come to know and appreciate many cultures and I have come to understand that the exchange between cultures is an important precondition for future developments. As a TV presenter, I try to nurture curiosity in children and young people

and thus sparkle enthusiasm for natural sciences. Because ultimately, thirst for knowledge is what sciences are all about.

In this spirit, I wish all participants an enlightening experience and an unforgettable stay in Frankfurt am Main. See you in 2020!

A handwritten signature of Ralph Caspers in black ink, written in a casual, cursive style.

Ralph Caspers

The Venues

The Kap Europa Congress Center

The Kap Europa combines a unique atmosphere with functionality. The congress center unites sustainable construction with first-class conditions, being the first convention building in the world to be awarded Platinum Certification by the German Sustainable Building Council for its green concept.

The Kap Europa perfectly matches the specific requirements for the academic program steered by the scientific committee. On the four levels, there are 12 conference rooms and 2 halls which can accommodate 1,000 and 600 people, respectively.

Within walking distance are the well-known Messeturm and the Skyline Plaza shopping centre. Popular sights can be reached within no time: Zeil or Goethe-

Jahrhunderthalle

The Jahrhunderthalle Frankfurt

straße for shopping, the town hall Römer, the Iron Footbridge on the Main, and the Museumsufer.

The closing ceremony will be held in the impressive Jahrhunderthalle, in Frankfurt Höchst. Designed by Friedrich Wilhelm Krämer and completed in 1963, the venue combines history with modernity and elegance with practicality. For a festive and glamorous event like the closing ceremony, we could not be luckier! Covered by glass windows and vaulted by its characteristic cupola, the 2,000 seat auditorium named "Kuppelsaal" is itself a sight worth seeing. The IJSO participants will be in for a treat even before the curtain rises!

The Jahrhunderthalle is a well-established international venue. It is contin-



The Kap Europa Congress Center

uously honoured by highly acclaimed international guests, such as world-famous ballet companies, symphony orchestras, rock stars, and comedians. Notable music performers include Kylie Minogue, Bryan Adams, Anastacia, Frank Sinatra, and many more. In addition, the venue hosts numerous general meetings, business events, and international conferences, such as the IJSO2020.



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