2WAYS
Communicating Life Science Research

The 2WAYS COOK BOOK

– recipes for science communication

2Ways is funded by the
European Commission
under FP7

SEVENTH FRAMEWORK
PROGRAMME

EUSCEA

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COOK BOOK

The 2Ways COOK BOOK is available on www.twoways.eu. Here you can find the recipes for all 17 2WAYS projects. The recipes will provide you with a quick overview of how European science institutes are developing, showing, and evaluating interactive and dialogical presentations of ongoing European life science research.

What have the European 2WAYS institutions been cooking? And what are the main ingredients in facilitating, arranging and communicating scientific research projects? With its 17 different projects, the COOK BOOK gathers the essential information you need to be inspired, informed, surprised, and simply become a little wiser on European life science.

TOOLBOX

– select the right tool for the presentation of your science project

The toolbox is filled with inspiring ideas on how to facilitate a stimulating presentation of your science project. The 17 newly developed 2WAYS science projects represent a wide range of tools and complete formats for interactive science communication. The toolbox gathers the essentials from the 2WAYS projects and highlights specific and concise formats for creating science presentations. Here is a box full of concrete tools to explore new ways of creating presentations specifically aimed at your target group.

NB!

Don't do this at home…

The following science projects should not be done without the presence of a scientist (scientific institution)

Enjoy!

About 2WAYS

The 2WAYS project is about developing, showing and evaluating interactive and dialogical presentations of ongoing European life science research. Science festivals, science centers, universities and research teams all over Europe participate in this groundbreaking project that also includes “science parliaments” on life science issues and an extensive impact study.

2WAYS is created and coordinated by EUSCEA, European Science Events Association, and supported by the European Commission, as a Science in Society project under FP7.

The 2WAYS project consists of 30 Partners cooperating with 33 scientific institutions from 17 countries. It is a two-year project for the years 2009 and 2010. The EUSCEA 2WAYS Grand Finals will show all 17 presentations about life science and will also present the first “Young Europeans Science Parliament” with delegates from the 29 local science parliaments.

About EUSCEA

EUSCEA (European Science Events Association, EUSCEA = pronounced “you see”) is the European association for organisations of European Science Communication Events (SCE).

SCEs have different names, they are called science - or research, or technology - festivals, weeks, days, summer or night of research. Many such events have evolved all over Europe, from Slovenia to Sweden, from Portugal to Poland, from Israel to Iceland, from Madeira to Moscow - and more are on the way.

EUSCEA is THE one and only platform to exchange experiences about the organisation of such informal learning events in Europe.

EUSCEA was founded in 2001 and has currently 99 member organisations from 35 countries. EUSCEA was coordinator of four EU funded projects so far.

2WAYS Toolbox

2WAYS Toolbox

In this toolbox, you will find five different presentation formats that can be used to successfully create a science communication event. The toolbox gathers the following essential presentation formats from the 17 2WAYS projects and outlines specific tools that can be used when creating creative science presentations: workshops, 2WAYS lectures, exhibitions, games, and science theatres. These formats take various forms and have different advantages and challenges. All formats aim to establish a two-way dialogue between scientists and the public.

The presentation tools used in the different formats are to be found at the end of this toolbox. The tools in the toolbox can be crisscrossed in the different formats: The workshop, exhibition and science theatre can all use posters, questionnaires, votes etc. as tools in their presentations. What is important is to use a creative composition of the different tools in composing a unique and compelling presentation. Of course, you can also make your own format by mixing the different presentation elements. Just remember that it is important to know your target group and keep it in mind when you start preparing your science presentation. The audience might have different expectations due to differences in age, education and culture. It can be necessary to adjust the performance to specific audiences.

Hopefully, this toolbox will inspire you to develop new and inspiring interactive presentations of ongoing life science research.

The coloured text below refers to the toolbox tools you will find at the end of the toolbox.

Formats

Workshop

A workshop can come in a large variety of different formats, but typically it includes a demonstration of methods or practical application of skills and principles. A workshop emphasizes the interaction and exchange of information among a small number of participants and is focused on a hands-on interaction between scientists and the visitors.

The workshop offers a great platform to present puzzling and surprising science research. The format is broadly defined, and the main element is that it is interactive. A workshop often includes many components. It can be like an extended exhibition with hands-on stations where the visitors can gain hands-on experience with different science research projects. It can also include direct dialogue-based elements between the visitors and the scientists.

To make sure that the workshop runs smoothly it is important to have a facilitator or tutor to run it. Often this will be a scientist who knows about the material and is also highly experienced in communicating science to non-experts.

It has shown to be a good idea to hand out souvenirs from each workshop for the visitors to bring home, preferably something they have helped create. This helps maintain the visitors' interest in the science.

Advantages: In a workshop, the visitors are activated and often use many of their senses learning about the subject matter. They gain first-hand experience with the topic and have the hands-on experience to remember it by.

Challenges: Even though you set up a great workshop, you're dependent on the visitors' goodwill to participate. Also, a workshop can be quite an extravaganza and often demands a lot of preparatory work.

Tools: Crafts Activities, Contest, Discussion Corner, Facilitator, Flyers, Movies, Open lab, Popular narratives, Posters, PowerPoint Presentation, Questionnaire, Science Café, Science Parliament, Stands/Stations, Votings, Website

2WAYS Lecture

In the 2WAYS project, the concept of traditional lectures has been expanded upon and brought to new uses. There are many different variations of this format and a range of tools that can be used to transform it to ensure a good contact between the audience and the speaker or scientist. The lecture format has generally been used with a specific focus on a two-way dialogue with the audience (e.g. by asking them to vote or including a game in the lecture). The dialogue is very important.

To engage the audience, it is always a good idea to try to visualise the science by including different media or dramatised elements, or by showing tangible objects and building the lecture around them. This can help stimulate the discussion.

In the 2WAYS-lecture you should also have a moderator helping to ensure communication between audience and the speaker. The moderator should clarify questions and help to create a relaxed and open atmosphere.

If you want to include a scientist in your presentation who cannot be present at the lecture, a good idea could be to utilise video lecturing.

Advantages: When an expert of a particular field shares her knowledge, it is possible to gain a profound understanding of the subject. Often the audience's interest is stirred simply because of the expert's personal and infectious approach and interest in the subject matter.

Challenges: The scientist is at the core of the presentation in a lecture, so it is important that the scientist is familiar with his audience and their level of pre-knowledge of the subject matter.

Tools: Experiments on stage, Facilitator, Flyers, Improvised sketches, Movies, Popular narratives, Posters, PowerPoint Presentation, Q&A Panel, Questionnaire, Science Parliament, Votings, Website

Exhibition

An exhibition, in the broadest sense, is an organised visual presentation and display of a selection of various items, posters, and banners. The core facts and pictures of the subject matter are printed. An exhibition doesn't need to be a one-way communication. Software tools, voting activities or debate corners can be used to make the elements interactive. A good idea is to set up an exhibition stand surrounded with banners. It is important to include lots of pictures to draw the visitors' attention. Also, different tangible objects are good to present, but there are many tools that can be used to make an interactive and exciting exhibition.

Advantages: An exhibition is set up absolutely on the visitor's terms. It has no secure chronology, but the visitor has the chance to crisscross and concentrate on elements he or she find particularly interesting. This is why the exhibition is somewhat the loosest format of the presentation categories.

Challenges: As the visitors wander around on their own and intercept what they find interesting, in can be difficult to measure exactly what they learn. If you want the visitor to ask questions when in doubt, it is important that the moderator is very conspicuous.

Tools: Crafts Activities, Discussion Corner, Experiments on stage, Flyers, Moderator, Movies, Open lab, Popular narratives, Posters, PowerPoint Presentation, Questionnaire, Science Café, Stands/stations, Votings, Website

Games

Games are a popular educational tool that can be used in an engaging way to gain insight into a field of science. When developing a game, it is important to use the scientific content as a foundation and develop the format of the game from there. Therefore, every game will have a different structure and setting. Some of the 2WAYS games have been developed to include a large audience, while others were prepared for small groups and meant to be played in a classroom. The games in the 2WAYS Cookbook also vary from more traditional board games to card games and online games as platforms to discuss e.g. ethical dilemmas.

Most games need to be conducted by a game master who is completely familiar with the step-by-step progression of the game. Before beginning the game, it is important to make a clear and sufficient introduction. To avoid confusion and make the best of the game, the rules must be very clear to the players before they begin the game.

To draw the interest of young players, it is a good idea to think of creative and fun names for the game. Prizes are also a good way to encourage the players, but they are not necessary. A game can also be designed to have no winners or losers. These choices are for the game designer to decide.

Advantages: A game is a great way to gain knowledge and have fun at the same time.

Challenges: A game has to be grounded in scientific content. Be aware that not all science projects are suitable for communication through a game.

Tools: Crafts Activities, Contest, Facilitator, Flyers, Posters, PowerPoint Presentation, Q&A Panel, Votings, Website

Science Theatre

A science theatre play is an unusual and exciting way to learn new things, as well as an excellent opportunity to actively engage with a researcher around science. Because of the visualisation and dramatisation of the science, it is a clear method of communicating implications, consequences and use of the knowledge gained through research. Because of its potential to stir emotions, it is an effective way to make people reflect over how different aspects of their daily lives are affected by science and research.

In order to maximize the experience for the audience - in terms of factual knowledge, dialogue and engagement - an on-stage performance can alternate between lecture-style presentations and theatrical scenes illustrating the science. Freezing a scene and having a scientist/presenter enter the stage to explain the scientific background, research methods and results is also a great way to keep the presentation varied and get the science into the play. Other tools can also successfully be used.

Both scientists and actors can be used in the play, but it is important to match expectations before you begin the science theatre project.

Advantages: An interactive play or performance is fun and engaging for everyone involved – for the audience, the actors, and the scientists.

Challenges: Keep your audience and their level of knowledge in mind when setting the content of the play. Audiences are often keen to learn new things, so being too general is nearly as problematic as being too technical. Be aware of your resources before you begin producing a play; it is a quite demanding format, as it includes a lot of technical equipment. Be also aware that technical difficulties can appear when working with equipment such as stage lighting and sound systems.

Tools: Experiments on stage, Facilitator, Flyers, Improvised sketches, Movies, Popular narratives, Posters, PowerPoint Presentation, Q&A Panel, Questionnaire, Science Café, Votings, Website

Tools

The following tools can be used as spices in the above introduced presentation formats. The links guide you to the tools that have been used in the 2WAYS project presentations.

Crafts activities	Include creative elements like drawing or making creative models or interpretations of the science. This is a good way to involve the visitors.
Contest	A good way to engage the visitors is by having them compete with each other.
Discussion corner	Set up a meeting point where visitors can ask informal questions to the scientists. Some interesting objects from the research can be displayed at the table as a starting point for dialogue.
Experiments on stage	It can be engaging to see spectacular experiments or science presented on-stage.
Facilitator	Most presentation formats need a facilitator to guide the visitors, kick-start communication between audience and scientist and keep the presentation on track.
Flyers	Produce flyers with more information and facts about the science research. This is an easy way to distribute your knowledge of the subject matter and very popular among the visitors.
Improvised sketches	To contextualise a discussion, improvised scenes can be performed in different ways, either by professional actors or by volunteer participants. A short sketch on issues that arise in the discussion can be played out, providing a concrete picture of the situation. The audience then can give their input to change the plot or comment on the scientific issue, providing new angles on a given issue.

Moderator	See Facilitator
Movies	You can make the science of the presentation very visible by making a movie that documents the science or scientists of your project. It is a good idea to include media students in this process. Including movie scenes (also from popular movies) is a good way to have the students relate to the topic.
Open lab	Make lab equipment available for the audience to get hands-on experience (e.g. microscopes where they can inspect living bacteria). Hands-on elements like an open lab especially attract audiences of families and children.
Popular narratives	To introduce different perceptions of the scientific topic and its social implications, a good idea could be to use popular narratives in your presentation, such as movies, books, artwork, newspapers, music, etc.
Posters	Posters will help convey the scientific content and are a great supplement for any of the presentation formats. With posters on the wall, the visitors can acquire the content at their own speed and in a selective manner. You can even hand out a poster to each group leader/teacher for them to take home after the presentation to remember the presentation by.
PowerPoint Presentation	PowerPoint presentations are often used effectively to communicate facts to the visitors.
Q&A panel	An idea is to have a panel discussion, where the audience gets a chance to ask relevant questions to the scientists. This is a way to get a debate started. A way to do this is to make the audience write down some questions that will be read and answered by the scientists at the end of the presentation.

Questionnaire	To get a good feeling of your audience, it can be helpful to have them fill out a questionnaire. This can be done as an opening to the presentation, but of course also to evaluate the outputs of the project presentation.
Science café	Let the visitors meet the scientists in a more relaxed setting for more detailed information and discussions. It is a good idea to have a moderator facilitating the dialogue. You can scale the settings according to need. A science café can be just four people in a room or a large-scale event with many speakers, microphones, lights, tables, etc. In the large version it is a good idea to have more scientists and researchers present representing complementary fields of the science behind the presentation.
Science parliament	The audience can also play the role of parliamentarians who discuss issues and come up with a political decision or declaration on the topic. As parliamentarians, the audience has to get relevant information that enables them to make well-informed decisions.
Stands/Stations	The science to be communicated can successfully be divided into different sections and presented at different stations or stands. The audience can visit the stations or stands in a particular or random order. Make sure to have an attractive visual element at the stands that will attract the attention of passers-by.
Votings	It can often be useful to set up a simple voting procedure related to the scientific content or especially to the ethical or societal implications of the science. The voting can relate to behavioural questions presented to the audience. There are many ways to make a voting procedure. It can either consist of a voting board and pen or glass bowls with beans or balls. It can also be stated more like an opinion poll with questions like, “What do you think of this issue?”

Website	Link to relevant websites (or social media platforms) or even create your own website with additional information on the science project. This is a great supplement to the flyer and an easy way to communicate larger sums of information.

After Dolly
– the ethical dilemma of animal biotechnology

By Agadem (Sweden) &
Wissenschaft-im-Dialog (Germany)

www.formidling.dk/sw15156.asp
www.sciencefestival.co.uk

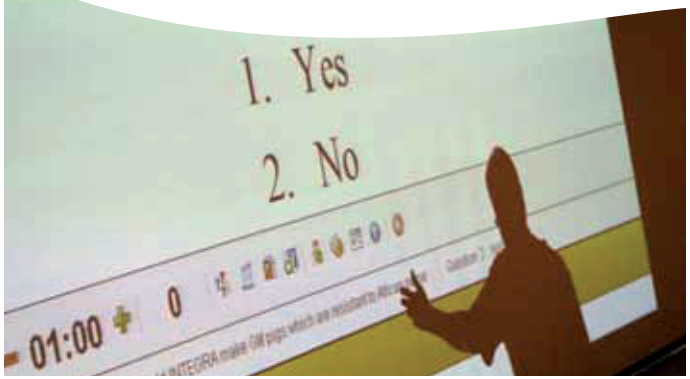
The science behind the presentation

Normally, animals breed offspring, which look like the parents. But new research enables scientists to alter the information in the egg cells of animals, in plants and bacteria by changing their DNA in some parts. This is done to help cure human diseases. One good example is the creation of special cells, which can produce insulin, a substance that is missing in people who have diabetes, a sickness where the sugar level in the blood is not under control. But many people feel that changing the DNA of animals may be harmful. How far can and should scientists go in their manipulation of domestic animals in order to produce food and for use in experiments?

Form Lecture

Target group 15 years and up

Introduction The research into transgenic animals is important in relation to the development of new biomedicine that can cure serious human diseases. The biotechnological opportunities push the limits of our everyday ethical understanding and come to terms with this development, the discussions about the ethical dilemmas and conflicts are crucial. In this presentation, the students will participate in a discussion about the dilemmas.



Ingredients

- A relaxed atmosphere. E.g. the audience could be seated around the performers
- Projector
- Screen for presentation
- Microphones for presenters and audience and runners
- Laptop (with .ppt images of Dolly, Glowing pig, African pig, European pig, Project questions + An animation of retinitis pigmentosa)
- Voting buttons – the audience's votes should be displayed on the screen (possible to replace with simple red and green voting cards)

Presenters

- 1 scientist (scientist 1) to explain the scientific background
- 1 scientist (scientist 2) to raise a discussion on ethical issues
- Moderator for the discussion

Preparations

It is important that the presenters focus on the three issues during the votings. The progression of the presentation depends on these and it is important that the participants get a feeling of the turn of the screw as the dilemmas get harder and harder.

Procedure

Introduction (25 min.)
Moderator welcomes audience and introduces scientists.
Scientist 1 explains the scientific background (what, how, why Dolly)
Scientist 2 (or a moderator) asks questions and gets the audience involved in the deabte (good, bad, why?)

Glowi/Fever Pigs (30 min.)
Scientist talk about fluorescent pigs and proposes research with pigs and swine fever (why make glowing pigs)

Blind pigs (30 min.)
Scientists explain how and why they would make a GM blind pig.
Is it a good idea to make genetically modified pigs, which are going to function as disease models?

Should INTEGRA make blind GM pigs that may serve as a model for Retinitis Pigmentosa?

Closing (5 min.)
Scientists explain why the audience's opinion is important (refer to Animal ethics online – youth parliament). Hopefully the presentation has conveyed to the audience the dilemmas and hard choices scientists engage in when new technologies are developed. It also shows the multidisciplinary that researchers have to handle. The votings follow the real dilemmas and issues that the INTEGRA project has had to address. Encourage the audience to stay involved.

Variations

With or without a moderator. It is possible to experiment with the roles of scientist and moderator. Also the role of the moderator can be more or less active.

Comments

If more presentations are held in a row it is interesting to save the voting results from one presentation to the other. This way interesting comparisons can be made based on the different audience groups.

Allergies

– Keep allergies at bay, learn from your play

By Lower Silesian Science Festival (Poland) & Vetenskap & Allmänhet (Sweden)

www.festiwal.wroc.pl/english
www.v-a.se/why_va

The science behind the presentation

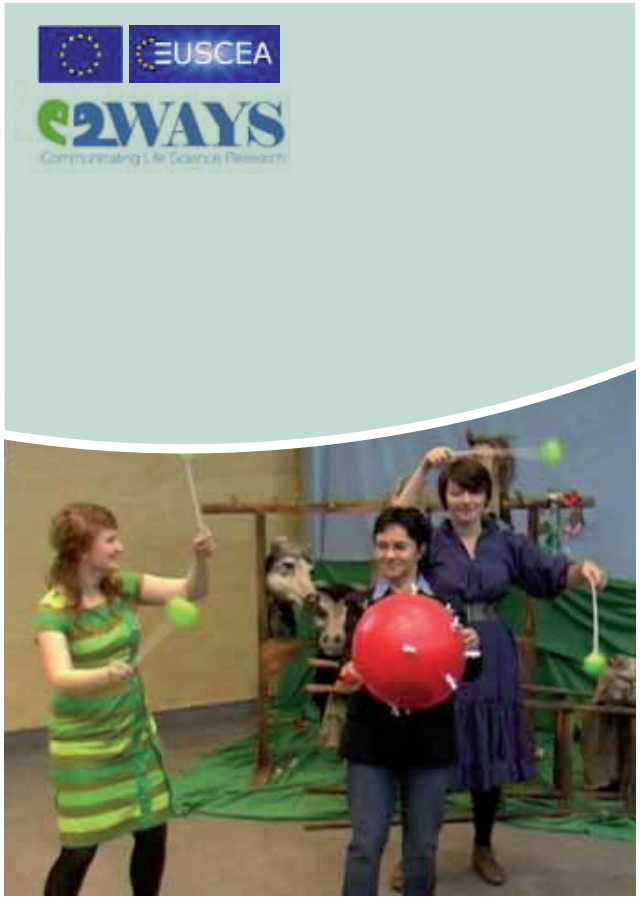
Asthma is a chronic lung disease that inflames and narrows the airways and makes them more reactive to certain substances breathed in. The exact cause of asthma is not known. Asthma affects people of all ages, but the symptoms typically appear during childhood. Many children who develop the disease will experience symptoms throughout life. The knowledge of many different areas of science like epidemiology, genetics, genomics, proteomics, bioinformatics, statistics, environmental ecology and immunology is applied in the research. The scientists hope to discover the genetic and environmental causes of asthma and to develop new preventive and therapeutic strategies to combat the asthma epidemic.

Form Science Theatre

Target group All ages

Introduction Medical definition of allergy and basic explanation of immune system work is given. Main respiratory and food allergens are described. Organs of the body that may be affected by allergens are mentioned and symptoms as well as illnesses caused by this influence are given.

The play combines different presentational techniques such as theatrical performances, PowerPoint presentations, Q&A discussions between scientist and audience and hands-on



activities like simple skin testing and other diagnostics. A scientist presents facts during the play. In this case facts on asthma and allergy, and different situations, implications, or consequences of these facts are illustrated using a theatrical performance by actors.

This mix of presentational techniques is designed to maximize the experience for the audience, both in terms of factual knowledge intake and direct dialogue and engagement.

Furthermore, a performance might come to stop and the presenter/scientist enters the stage explaining the scientific background, research methods, research results etc, at the same time inviting questions and comments from the audience. This is carefully designed to achieve maximum interactivity, exchange of ideas and dialogue between the audience and the people on stage.

Ingredients

- A venue with a stage
- 1 project manager or coordinator
- 1 carefully selected topic/theme/facts to communicate
- 1 researcher
- 2-3 actors - professional actors, actor students, young people or puppets
- 1 venue
- 1 technical set up
- Audience
- Souvenirs: Pollen Calendars and 2WAYS Presentation Leaflets
- Lighting that can be adjusted to the needs of the scenes played
- Sound: Roaming wireless microphones that allow the scientist and/or actors to freely move around.
- Computer, projector and screen for slide presentation
- If required, overhead projector and/or flipchart and marker pens

Preparations

Prepare the souvenirs for the visitors:

The Pollen Calendar
Could be a map of your country with different regions with different pollen and mould spore concentrations in different periods of a year.

The Presentation Leaflet

Should include the abstract of the issue and the information about the scientist – scientific interests as well as personal details such as hobbies etc. It should also contain advice for people allergic to dust mites, pollen allergens, and animal fur (with links to a website to learn more).

Procedure

The specially prepared souvenirs – Pollen Calendars and 2WAYS Presentation Leaflets – are distributed among all visitors.

The play:

Stage 1 – Theme, partners and setting things up

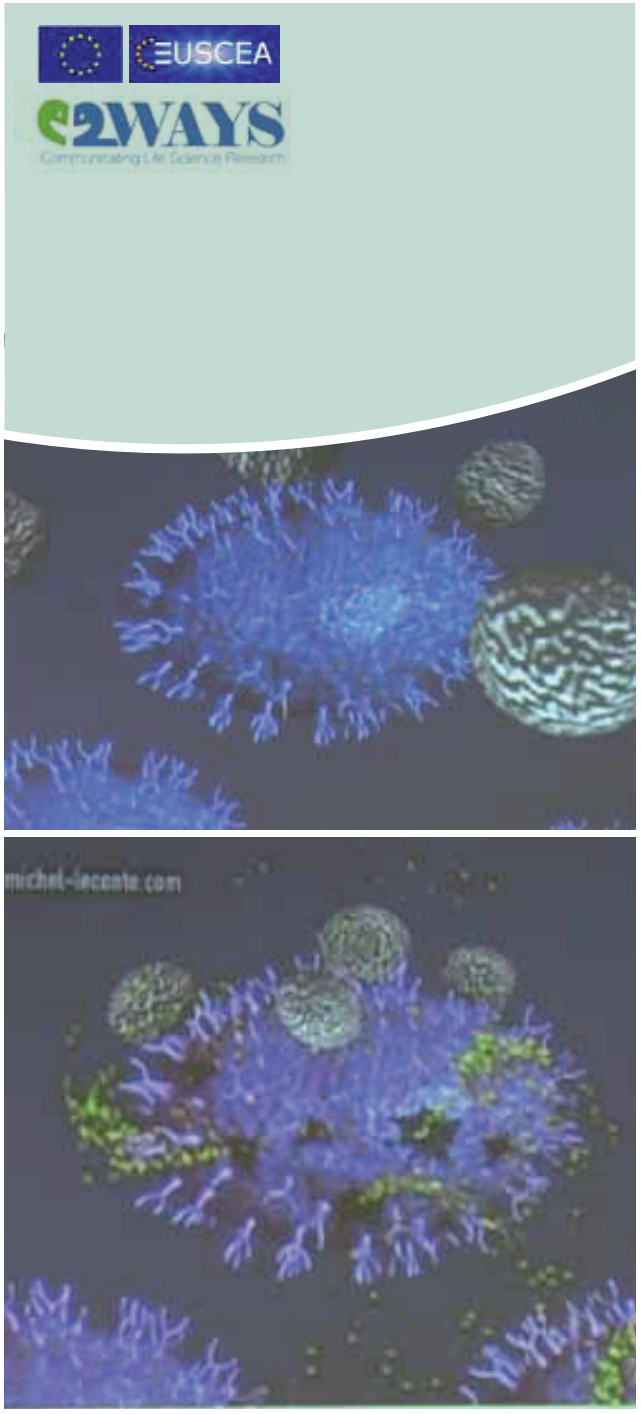
- Assign a project manager or event coordinator.
- Identify a suitable research topic/theme – to which the audience can easily relate.
- Identify, contact and recruit a scientist to the project.
- Decide on a suitable theatre company and contact them.
- Identify and contact suitable venue.
- Invite audience.

Stage 2 – Develop content

- Together with the scientist, the project manager decides on the framework of the play, including length, factual content and the number of theatrical performances.
- Once a framework has been drafted, the actor, scientist and the project manager move on to develop the specific facts to be presented and details of the performances.
- Decide on presenter/moderator (optional).

Stage 3 – Rehearse and perform

- Create and script the dialogue and interplay between the actor and the scientist.
- Rehearse and make necessary adjustments. The number of rehearsals required depends on the complexity of the play script.
- Perform the play and evaluate through questionnaires.
- Debrief and collect "learning points" for future improvements.



Comments

Paying close attention to the age and level of knowledge of your audience is important when setting the content of the play. As audiences are often keen to learn new things, being too general is nearly as bad as being too technical. The scientific part of the play, in particular the use of terminology and concepts such as theories and hypotheses must match the level of knowledge of the audience. Theatrical performances work over a broader range of audiences resulting in less need for adaptation; however some minor adjustments can make a big difference.

Be a Bechstein's Bat

By Forum Democrit (Bulgaria)
& International Science Festival Göteborg (Sweden)

www.green.democrit.com/en/index.php
www.goteborg.com/default.aspx?id=8691

The science behind the presentation:

Scientists have studied bats in many ways. For instance, if bats are not healthy then their habitat has likely changed crucially. This research can help determine the design of conservation plans. On the other hand, bats are very social animals and many things can be learned from their behaviour. The Bechstein's Bat is the only bat species in Bulgaria. It lives in the forests. Its behaviour and wellbeing can indicate whether the forests are in good shape or not. Thus, the Bechstein's Bat is considered a so-called 'umbrella species'. Through protecting it, the whole biotope with the typical complexity of species in such a forest is also protected.

Form Theatre play

Target group Science Theatre

Introduction Knowledge of bat biology is important because bats are of high conservation relevance. With many bat species threatened, precise information on their biology is required to design appropriate conservation plans. In addition, bats are of particular interest for behavioural and evolutionary biology because most bat species are social.

Ingredients

- A dark old room
- 10 meters black textile
- 15-20 lights
- Bat costume

- 2 laptops
- 1 amplifier
- Microphones
- Ropes and other alpinist items
- 2 beamers
- Proper cables
- 2 screens
- Enthusiasm (in large doses)

Presenters:

- 1 project manager
- 1 or 2 coordinators
- 1 director
- 1 stage decorator
- 2 stage-hands
- 3 sctors/actresses
- 1 sound technician
- 1 light technician
- 1 cable specialist
- 2 musicians
- 1 or 2 scientists
- 10 volunteers

Preparations The presentation requires that the scenario is both scientifically based and easy for the

audience to understand. This requires close collaboration between the scientists and the director in order to reach the required combination.

This presentation requires that the actors learn their texts and all scientific terms and other specific words.

Procedure

Prepare the space for the play. It is important that every floor of the building represent a different stage of the life of the bat. For the play, it is important to find an enthusiastic team:

- The enthusiastic scientist
- The enthusiastic actors (and instruct them well)
- Leave the director to do his job
- Do some marketing to attract the proper age audience

Comments

Be sure to make an action plan and a time plan for the project.

Be sure that the scenario is scientifically based and easy to understand.

Both scientists and director have to work together to reach this amalgam.
Be sure that the actors learn their texts with all proper scientific terms and other specific words.

Make sure to do proper marketing.

To set up a theatre play in different countries takes a lot of resources. Be clear on resources before you begin the process.

Gene mutation
– is it all bad news?

By CALMAST (Ireland)
& CELS Centre for Effective Learning in Science (UK)

www.livingearth.ie/index.html
www.ntu.ac.uk/cels

The science behind the presentation

Gene mutation is a permanent change in the DNA that makes up a gene. This may be a simple substitution of one DNA building block with another or may be a substantial change in a chromosome. Mutations can occur in two ways: Inherited from parents or by environmental factors. Gene mutations can have a beneficial or detrimental effect. Mutations in DNA code can cause diseases like cancer, or haemophilia, but not all gene mutations are 'bad news', some changes in DNA have no effect and other changes may even be favourable.

Form Game

Target group Students

Introduction The Mutation Game is an interactive game with particular emphasis on mutation due to ionising radiation and will allow study of causes, effects and ethical issues. The games and presentations will address common public beliefs and fears regarding mutations and radiation. The Mutation Game does not have winners or losers. The game aims to show 'evolution in action' in a very short period of time. The fact that DNA mutations can have both positive and negative effects is repeatedly emphasised. The Mutation Game, developed in collaboration with GENIE, University of Leicester (UK), is an interactive game with particular emphasis on mutation due to ionising radiation and will allow study of causes, effects and ethical issues.

Ingredients

- Tables (one bigger table to take the game board – depending on size printed out)
- Chairs
- One set of the game (available on request) which includes one board game, rules for playing, player species, mutation cards, events cards etc . The board needs to be printed out in colour and (laminated recommended). The game cards need to be printed out on different colour paper (thicker card eg 160 g/m2 recommended, or laminated).
- Game counters (at least 6) one for each team (large scale recommended).
- One dice (large scale recommended so all can see clearly).
- Plastic wallets

- Non-permanent markers
- Tissue.
- Minimum of 8-10 student visitors

Presenter

- At least one facilitator to explain and 'run' the game - ideally two people, eg scientists and/or science teachers.

Preparations

Identify a school partner and set up a time to discuss with the teacher beforehand. Explain the science and how it fits with curriculum. The organisers should play the game for themselves before the event to see how it works.

Procedure

3-6 players in each group. (Note: one board game can accommodate up to 36 people at the time)

The Mutation Game is a board game designed to be played in a classroom. The design of the board is flexible so that different versions of the Mutation Game can be played on the same board using different sets of cards. Players move clockwise over the board by throwing a dice. Mutations and events will happen to each player.

The Evolution Game is the first version of the Mutation Game and has been developed in collaboration with GENIE (University of Leicester, UK). The Evolution Game is set on an alien planet and aims to show 'evolution in action' in a very short period of time.

There will be a maximum of 6 players, representing 6 very similar species that live on an alien planet. At the beginning of the game, all species have an identical body plan and colour and only differ in the number of legs, eyes and antennas. During the course of the game, the population size of each species will increase and physical changes will happen to each species, e.g. change in body shape or colour, hair, extra legs, extra eyes, ears, fangs, tail, stripes, dots etc. Furthermore, events will happen to individual players and to the planet, which may or may not affect the population size of the players.

Variations

A second version on Mutation and Disease is under development.

Live and let die

– why do cells die during the aging process?

By Karl-Franzens-University Graz (Austria)
& Eberhard Karls University (Germany)

www.uni-graz.at
www.uni-tuebingen.de/en/international.html

The science behind the presentation

Cells die and a special mechanism called apoptosis leads to rapid removal of unwanted or damaged cells. In bodies like ours with a huge number of cells, the purpose of this 'programmed' cell death is obvious: Single cells die for the benefit of the whole organism. But since a bad regulation of apoptosis can result in human diseases such as neurodegenerative disorders, spread of viral infections, AIDS, cancer, and cell death during the ageing process, apoptosis is of particular importance for medical research and therefore of public interest.

Form

Games

Target group

For Game 1: "Organellory": 5 years and up
For Game 2: "Apoptopoly": 12 years and up

Introduction

Apoptosis is a "cellular suicide programme" which rapidly removes damaged or unwanted cells from the human body. Malfunctions in this process may result in neurodegenerative disorders, viral infections, AIDS, or cancer. In this presentation, the interactive games "Organellory" and "Apoptopoly" will explain the purpose and scientific questions regarding apoptosis, without requiring a basic knowledge of science.

"Organellory" is based on the game Memory and aims to provide insight into "The Cell" by pairing cellular components (organelles).

"Apoptopoly" is based on the game Monopoly and is designed to give deeper insights into the mechanism of two kinds of programmed cell death: Apoptosis and necrosis.

Ingredients

- 1 table for each game (the so called game table)
- Special designed posters with the scientific topic of both games
- Plants and flowers for decoration (to make a pleasant ambiance)

Game 1: "Organellory" (1-4 players)

- 1 tables
- 22 cards (cellular components)
- 1 game-master

Presenter:

The game requires a game-master to explain the function of the cellular components and to answer question concerning 'The Cell'.

Game 2: "Apoptopoly" (2-6 players)

- 1 table
- 1 Game board with dices and counters
- 4 sets of game-cards: Action cards; death cards; survival cards; question cards, and organelle cards
- 1 game-master

Presenter:
The game requires a game-master to explain rules, pose questions (death cards, question cards, action cards) and answer questions concerning „Programmed cell death“.

Preparations

All scientists must know how to communicate about the topics in an understandable way. Also it is important for the scientists to be familiar with the actual games before the presentations.

Make posters with the scientific topic of both games.

Procedure

Winner of the game “Organellory” is the one who discovers most of the cellular components.

Winner of “Apoptopoly” is the one who collects at first 5 organelle cards.

Comments

A useful strategy to motivate visitors to join the game is to hand out additional awards.

MiNDstake
+ ND Neurological diseases

By Universita della Svizzera Italiana (Switzerland)
& Associazione Festival della Scienza (Italy)

www.usi.ch/en
www.festivalscienza.it/en/festival/index.php

The science behind the presentation

The brain is the most complex structure in the human body, responsible for all our thoughts and actions. It makes us who we are. Researchers around the globe are striving to discover the mysteries of brain and mind, from consciousness to memory, from development during childhood to the consequences of ageing. Progress in brain research has a direct influence on our daily lives. Brain research is not just about understanding the healthy brain. Brain diseases and disorders are some of the biggest challenges that neuroscience faces. Across Europe, 127 million people are affected by at least one brain disease. These diseases include Alzheimer's disease, head injury, motor neurone disease, pain, drug and alcohol addiction, dyslexia, and many others. Groundbreaking advances in neurosciences made in the last decade are crucial for the public to know about. The MINDSTAKE project wants to bring this information out of the lab and into the public arena.

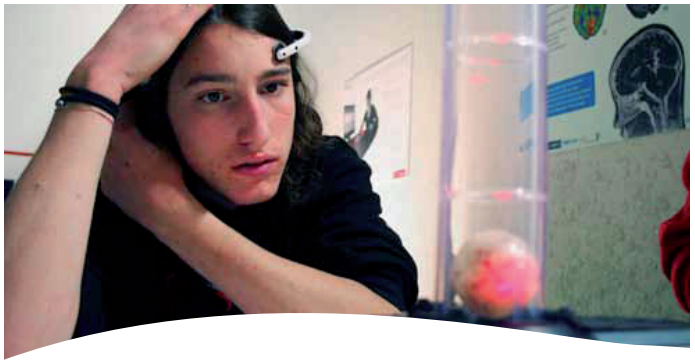
Form Exhibition / Games

Target group 12 years and up

Introduction This exhibition/game wants to make visitors aware of the extraordinary capacity of the mind and scientific aspects of the brain.

Ingredients

- 2 rooms per class (of 20 pupils): one room for exhibition, the other room for projection



- 2 animators, 1 of which is a neuroscientist (biology or medicine)
- Information panels, especially created for the MINDSTAKE project, illustrated the scientific information about brain, neurons, and brain disease.
- PowerPoint presentation about illusions and video about scientific projects on Brain Machine interface.
- 15 interactive exhibits about the senses: Sight, Hearing, Touch, Balance, Temperature, and Proprioception, and Pain.
- One microscope with neurons and astrocytes preparations
- One whole human brain
- One emotive system
  www.emotiv.com
  www.youtube.com/watch?v=40L3SGmcPDQ

- One Mindball game
  www.mindball.se/product.html
  www.youtube.com/watch?v=3dJwvjq6eik

- One Mindflex game
  www.mindflexgames.com
  www.youtube.com/watch?v=l8STHiP7HZY

- 3 videos:
  www.youtube.com/watch?v=0-1sdtnuqcE
  www.youtube.com/watch?v=q-fE9QBy0FI

www.youtube.com/watch?v=ppILwXwsMng&playnext =1&list=PL4BB7D727316F9D52&index=2

Preparations Set up an exhibition with information panels and video projection.

Procedure With the help of the information panels and PPT projection presenting the functions and the core aspects of the neurosciences.
The exhibits (with visual, auditory, tactile, illusions) presenting the perception modality of the brain, and the Brain Machines interface games the frontiers of neurosciences.
The basic information about neuroscience is discussed with help of a brain preparation, a whole human brain and a microscope.
A video projection shows a short film concerning the application of the BMI science.
The emotive system presenting an electroencephalogram and other BMI applications.

Comments Mindstake is not reproducible if you don't have a mindball (12'000 €), an emotiv system (2000 €), brain slices, a whole human brain (6000 €), microscopes (2000 €) , and 15 specific exhibits about perception and illusions (with a total value of 10'000 €), and 20 scientific panels.

For more information: www.ticinoscienza.com

Puzzling Messages

By Dialog Gentechnik (Austria)
& Talència (Spain)

www.dialog-gentechnik.at
www.talencia.cat

The science behind the presentation

Every function of our body, from digestion of food to thought or movements, requires gene products, which are produced according to messages in our genes. Though it may sound strange, these messages written in DNA are not continuous, but with words (exons) separated by meaningless letters (introns). For the information in a gene to be used, these introns must be removed. Thus our cells make copies of genes in the form of a molecule called RNA, and a process called gene 'splicing' removes introns to produce a final message, the template for a gene product. The apparent advantage of splicing is that from one gene different combinations of words can give rise to different messages. This partly explains why our genome, with a number of genes not much larger than those of worms and insects,can build more complex organisms.

Form Workshop

Target group 12 years and up

Introduction Each function of our organism, from digestion to movement or thinking, requires instructions included in our genes. These 'instructions' are DNA molecules. Although it may seem strange, the messages that our genes convey are not "written" in a continuous way, but with "words" (exons) separated by characters without any meaning (introns). In order to be able to interpret the information conveyed by a gene, the apparently useless regions should be eliminated. That is the reason why our cells make

DNA copies in the shape of another kind of molecules called RN, eliminating the meaningless fragments through a process called alternative splicing.

The advantage of the genetic splicing is that it allows the assembly of different combinations of the "words" (exons) contained in our genes, giving place to different messages from each individual gene. That partially explains why our genome, with a number of genes no bigger than those of worms or insects, is able to generate more complex organisms.

Faults in genetic splicing, for instance those produced by mutations in our DNA, cause diseases like cystic fibrosis, neuropathologies, or myopathologies.
Alterations in the production of different instructions by alternative splicing influence the development of numerous pathologies, from muscular dystrophy to neurodegenerative diseases or different kinds of cancer.
Understanding the processes of genetic splicing and alternative splicing can facilitate the development of new therapies for these diseases.

Ingredients

- At least 2 sets of puzzles, one formed by words and the other by characters
- 1 mirror (or a mirror film mounted on cardboard) for each puzzle
- Paper rolls 12 or 10 cm wide and 80 g/m2 thick
- Finger paint in different colours
- 2 paint rollers per play
- 1 paint tray per play
- 2 mirrors
- Wet & dry clothes
- Sponge for cleaning
- Cloves for presenters
- 2 info-posters
- Leaflets

Settings:

- Covered stand
- 1 table (covered in plastic) per puzzle

- Chairs
- Posters
- Roll-ups

Animators and presenters

- 1 or 2 scientists
- 1 assistant

Preparations

The puzzle is placed in front of the mirror, so that the words can be read as the letters are mirror-inverted due to the printing-function. The paint tray with a little paint, the paint rollers and the paper is placed right next to it (see pictures).

One presenter should present one puzzle only; presenters should be tutors trained in communicating molecular biology, students of biology, or young scientists with a research focus in alternative splicing.

Procedure

The presenter (scientist, tutor) stands behind the mirror and explains the main concepts (genetics, DNA, RNA, splicing, exons and introns) to the visitors, underlining the theory by using the puzzles principle.
The participants are then asked to form different words or sentences with the puzzle. For printing (which would be translation in the biological context) paint is applied with the paint rollers and the word or sentence is printed on a strip of paper (see pictures). Participants can take home the print, which would be the protein in the biological context.

Variations

Depending on how man people are attending the hands-on activity, participants can also be asked to form as many words as possible.

If you're working with smaller groups, two groups can compete against each other: Which of them have all possibilities printed first.

Comments

A useful strategy to motivate visitors is to hand out awards.
The paint must be removed with water and a sponge before putting away the puzzles.

Recreating Life

By Paris-Montagne (France)
& Psiquadro - Perugia Science Festival (Italy)

www.paris-montagne.org
www.perugiasciencefest.eu

The science behind the presentation

Synthetic biology is the research field referring to the design and fabrication of biological components and systems that do not already exist in the natural world. It is also the field of redesign and fabrication of existing biological systems. Biologists are interested in synthetic (artificial, man-made) biology because it provides a new perspective from which to consider, analyse, and ultimately understand the living world. Being able to design and build a new system is also one very practical measure of understanding. Physicists, chemists and others are interested in synthetic biology as an approach with which to prove the behaviour of molecules and their activity inside living cells. Applied research fields such as bioengineering are aimed at reconstructing living systems or integrating biological and manufactured materials: From muscles to bones to skin.

Form

Lecture / Game

Target group

12 years and up (best for upper secondary school pupils)

Introduction

The lecture/game is designed to stimulate discussions on ethical or social issues raised by scientific achievements, without losing a solid basis on actual research. The scientific question is introduced through the lenses of a popular myth and short excerpts from popular films (from Young Frankenstein over Hulk to GATTACA).
The discussion is guided by priority games, role/situation games, and discussion continuum. Information is brought to the participants through popular media (TV, YouTube, Wikipedia). A young scientist helps keeping the discussion on the right tracks and provides additional information on request.

Ingredients

- A room with possibility of creating partial darkness
- Video-projector
- A computer
- 4-5 tables
- 25 chairs
- A clean wall to hang the cards during the games

- A projection screen
- Audio system
- Narrative objects: a Superman/Big Jim puppet without head, a rubber brain, a plasma lamp, a demonstration banner: “Frankenstein: No thanks!”
- Set of cards for discussion continuum (A4, laminated)
- Set of cards for priority game (A5, laminated) (optional)
- Patafix (blu-tack) for fixing the cards to the wall
- DVD “Recréer la vie / ricreare la vita”
- Leaflet

Presenters:

- 1 or 2 animators who know popular tales about recreating life (Frankenstein, Pinocchio, JurassicPark, etc.) and the development of synthetic biology as well as the modification of living organisms

The role of the animators is to devote themselves to each discussion topic, seed the discussion, and keeping it on the right track.

- 1 or 2 scientists with knowledge of the issues related to the applications of biotechnology and genetics.

The scientists intervene when questions are asked, when participants are very wrong on specific facts and need to be corrected, and when additional information is needed.

Preparations

Short training is needed for both the animator and the scientist:

Animators

- principles of facilitating discussion games and dialogue games
- reading/watching popular tales on recreating or modifying living organisms (from Frankenstein to Pinocchio)
- reading general information on synthetic biology
- watching several times the « Recreating life » DVD

Scientists

- principles of discussion games and dialogue games

- introduction to the differences between giving a lecture and helping a discussion
- introduction to the complexity of the interactions between expert-knowledge ad non-expert knowledge, and to the respect of emotionally-based opinions

Procedure

Introduction to the theme by engaging the audience:
Interactive introduction to the movie through narrative objects (see ingredients): "How many of you know some movies or stories on recreating life?"

Movies, 1
Extract of Young Frankenstein 'Calm and dignity'
Extract of Young Frankenstein 'It could work'
Extract of Young Frankenstein 'Discussion with the students'

Intervention (5 to 10 min):
The scientists explain their work and the fundamentals of synthetic biology and/or bioengineering.

Movies, 2:
Gattaca: 'Birth of the first child' (theme: Knowing the likelihood of illness)
Gattaca: 'Choice of the second child' (theme: Choosing the characteristics of the child)

Discussion game,15 min:
One animator explains the rules of the game. During the explanation, the boards "possible" and "impossible" are pasted on the wall by the other animator: they represent the two "poles" of the first part of the discussion. To start the game, one of the animators takes the card "create human beings without heart problems" or "choose the gender of one's child". He explains which side, closer to "possible" or closer to "impossible", he would place it and why. Then the participants are asked to pick another card, read it aloud, and place it between the "possible" and "impossible" cards on the wall. The other participants will agree/disagree with him/her. A certain level of chaotic discussion should be allowed by the animator.

Movies, 3:

Monkey Business. “Advertising campaign” (introduction to the story of the movie. (Message: Scientists may have interests and problems which are different from others) Jurassic Park. “Could or should do?” (Introduction to the story of the movie. Message: Crossing the line between being able to do something, and choosing to actually do it, between technical feasibility and social acceptance)

One of the animators flips the cards: “possible” becomes “desirable”; “impossible” becomes “unacceptable”, thus the two new poles of the discussion are now “desirable-unacceptable”.

NOTE: This is the crucial passage of the activity. It should be carefully introduced and a sense of suspense should be created.

The animators ask the participants if they think that the positioning of the cards is still valid for them, now that the two poles have changed. They show an example of a card that could possibly be moved from its original position. Then one by one the cards are examined again and moved if necessary, based on the opinions of the participants, closer to “desirable” or to “unacceptable”.

Variations

Priority game (optional, only for participants over 14 years of age) (10 min.)
At the end of the workshop, the participants reflect in small groups.
Five different cards are distributed to the groups: “Recreating life is a technical issue/problem”; “Recreating life is an ethical issue/problem”; “Recreating life is a societal issue/problem”; “Recreating life is a juridical issue/problem”; “Recreating life is a religious issue/problem”; “Recreating life is a scientific issue/problem”

The cards are placed on the wall. Differences and similarities are analysed. The animators ask the participants to justify their choice and report the discussion of the groups.

Film/examples (optional) 10 min
The extracts show that the problem has many facets. They can be shown and discussed according to the previous discussions:

– Technical: Young Frankenstein, Frankenstein, GATTACA, etc.
– Ethical: AI, Monkey Business, Frankenstein, etc.
– Societal: Young Frankenstein, GATTACA, etc.
– Juridical: GATTACA, The Island, etc.
– Religious: AI, etc.

Comments

Ideally visiting groups of 10-25 people.

”Recreating life” is a dialogue-workshop, targeted at teenagers, and based on three key communication principles:
1. use of popular narratives to introduce the scientific topic and design the guidelines for discussing it;
2. use of participatory and dialogue activities to promote the discussion;
3. direct participation of research scientists in the dialogues to help grounding the discussion on real science.
The first principle is aimed at integrating in a learning activity the elements that shape the image of science among teenagers: popular films are an element of shared knowledge, that set a platform for discussion which cancel differences among participants (for example, their performance in school or their cultural background); the third principle is aimed at promoting a participatory culture in tomorrow’s citizens; the fourth element is aimed at keeping a strong connection with science in its making and help identify facts, fiction and opinions, respecting all three of them in their legitimate role.

The changing of rhythm and posture among these three moments is a key to keep the attention and the motivation alive.

The role of the mediator/animator is essential as he/she will be in charge of keeping the discussion on the right track without preventing interesting suggestions to emerge from the audience and without letting the experts monopolize the agenda.

Robo-beetle

By Bristol Natural History Consortium (UK)
& Daugavpils University (Latvia)

http://www.bnhc.org.uk/
http://du.lv/en

The science behind the presentation

Bionics is the application of biological methods and systems found in nature to the study and design of engineering systems and modern technology. Engineering tools for flight dynamics and control are used to analyse physiological and biomechanical data from real animals. The investigation of animals and plants could help to learn more about natural solutions to various technical problems experienced when trying to do the same things the same way as animals do it (e.g. flying). This would allow humans to learn that even the smallest creature in the world can teach some specific skills and that the animals' importance in everyday life should not be neglected. If there were no beetles then the eco-system of the world would crash down.

Form Workshop

Target group All ages

Introduction Insects bristle with sensors, but how do they exploit this rich sensory information to achieve their extraordinary stability and manoeuvrability? Bird and insect wings deform in flight, and have passively deployable structures such as feathers and flaps, but how do they exploit these features when aircraft designers shy away from aero-elasticity? Birds fly without a vertical tailfin, but how do they maintain yaw stability when most aircraft require one to fly safely?

Science is unique in using the engineering tools of flight dynamics and control theory to analyse physiological and biomechanical data from real animals. One research track will use measurements of the forces and torques generated by insects flying tethered in a virtual-reality flight simulator to parameterise their equations of motion, in order to model the input-output relationships of their sensor motor control systems.

In the workshop, a Robo-Beetle with associated display and educational materials, is used to create a dialogue between scientists and the public. Visitors will have a unique opportunity to find out more about skills, characteristics, and specific features of insects.

Ingredients

- An area wide enough for the robo-beetle to move
- 1 robo-beetle (it may be any simple robot – which may be moved by a console or it may be more complicated – moving around on its own.) The cover resembles a beetle – made of various materials (e.g. foam plastic, fabric etc.)
- A screen
- A media presentation
- Sensors (if possible).

Presenters

- 1 robo-beetle guide
- 1 scientist showing and commenting on the media presentation

Preparations

The robo-beetle is prepared beforehand depending on financial and technical possibilities.

Prepare media presentation.

Procedure

The moving robo-beetle displays some intellectual features and works as a perfect eye-catcher. The additional media presentation gives information about bionics. The scientist explains all the details and answers the questions.

Comments

The presentation is successful if the scientist attracts the attention of the visitors by offering details on the robo-beetle while it is moving.

SNEEZE!
- on influenza pandemic

Ciencia Viva, Portugal
& By Heureka - The Finnish Science Centre

www.heureka.fi
www.cienciaviva.pt/home

The science behind the presentation

Europe may be one of the most developed areas of the world but it still faces problems with infectious diseases. Some familiar ones – such as salmonella and measles – continue to pose serious health risks. There are also new problems to tackle including those caused by demographic changes, population movements, changes in the way food is processed, and the threat of bio-terrorism. Europe must respond quickly to diseases and put in place effective control and prevention programmes to limit their spread. To improve public health decision-making, mathematical models are increasingly used to estimate the impact of control programmes against infectious diseases but the accuracy of model predictions depends on the quality of the data used.

Form Game

Target group All ages (best for upper secondary school pupils)

Introduction The game illustrates how accurate information about pandemics and vaccination is communicated in an impressive way.

The game takes about five minutes.

Ingredients

- Auditorium or another space suitable for about a hundred people.
- At least fifty, but preferably one hundred attendees.

- Space for the presentation
- 1 computer
- 1 video projector.
- Posters about pandemics and vaccination (if possible)
- Flyers with info about pandemics and vaccination (if possible)
- 50 small yellow post-it notes
- 100 alike letters made beforehand
- A paper mailing-list (for participants who are interested in receiving more info on pandemics)

Presenters

- One academic performer who tells briefly about pandemics, researching them and their spreading models.
- One assistant, who is familiar with the rules of the pandemic game.

Preparations

Prepare 100 alike letters containing 6 cards: 2 red and 4 blue.

Procedure

"The Pandemic hits" Heureka-game

Every attendee receives an envelope with six cards. Two of them are red and four of them are blue. Additionally, half of the attendees also receive a post-it note pasted onto their envelope.

The game starts with everyone standing up. The facilitator (the academic briefer) gives permission to open the envelope. The facilitator is "the source of the infection". He/she is placed in the middle of the auditorium and is advised to give the cards from his/her envelope to a random person standing close. After the assistant has dealt their cards, he/she sits down - "suffering from the pandemic".

The six people standing close to the assistant have now different coloured cards. The people holding blue cards have met the "source of the infection", but haven't "been infected". They remain standing. The ones with the red cards have "been infected" and will open their envelopes to deal out their cards to the people standing or sitting close to them. This demonstrates that a "pandemic" spreads, but not through every physical contact between humans. The game is continued step by step, but cards are dealt only

when the leader of the game gives permission.
Everyone who has been dealt a red card sits down to "suffer from the pandemic". They can also be dealt another card and get a "new infection".
People having received a blue card can receive another blue one and "evade the infection" or finally receive a red card and "get infected".
The game proceeds for six or seven steps. Often groups of "non-infected" players remain, and if someone has stood apart from the others at the beginning of the game, they might not receive any cards. Some players get multiple red cards, "multiple infections", and some many blue cards, "immune to infections".

After the game is over, the spreading of the "pandemic" is discussed together. Different models are easy to demonstrate in a simple computer program used for picturing the spreading of pandemic.

Finally, the role of the post-it notes is revealed for the players. Through inspecting the placement of the yellow "vaccination" notes it is possible to check whom of the "infected" could have been spared of the "pandemic" and how the "vaccination" would have stopped the spreading of the "pandemic" also to the players "not vaccinated".

Variations

According to the different audiences, the game can be called Gossip or in a more exciting way Heureka-pandemic or even Deadly Plague – to delight the young players.

Different amounts of blue and red cards can be used. Different amounts of post-it "vaccination" cards give a different result.

Several games can be played in a row.

Comments

Supplement with releasing more information on website.

Without clear instructions step-by-step for when to open the letters, the game will easily become chaotic.

Stem Cells

- Rethink Stem Cells for Future Therapies

By Jardin des Sciences (France)
& Bloomfield Science Museum Jerusalem (Israel)

www.unistra.fr/index.php?id=unistra_en
www.mada.org.il/en/default.aspx

The science behind the presentation

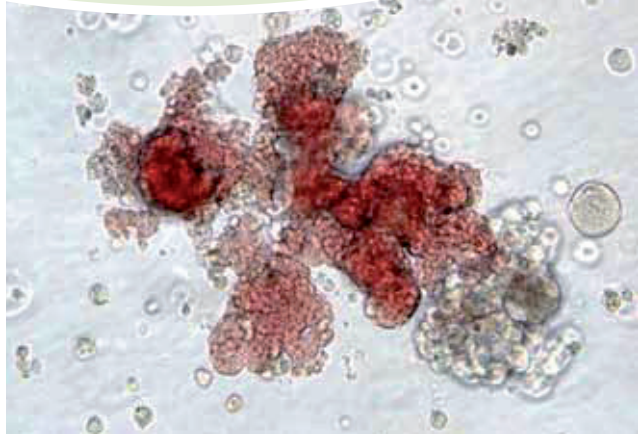
Recent developments have opened up new possibilities for the use of stem cells in the treatment of human diseases – such as Huntington's disease – which often prompts social and ethical concerns regarding issues such as genetic counselling, genetic testing, insurance and employment problems for people carrying the disease. However, one of the principal sources of stem cells is the human embryo. These techniques also give rise to doubts, fear and opposition. National, European and international regulations provide a framework for research on stem cells and so it is important to grasp the value of this research.

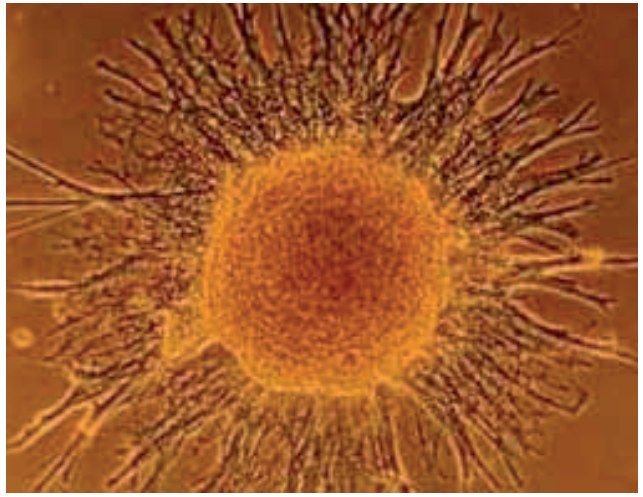
Embryonic stem cells are pluripotent, meaning that they are unspecialized cells capable of differentiating and producing any type of cell in the body of mammals: blood cells, bone cells, muscle cells, nerve cells, and more. The cells are extracted at a very early stage of embryonic development, shortly after the egg is fertilized by a sperm cell. A faulty protein that takes on an abnormal form causes Huntington's disease. Most often, the body's cells are able to combat these faulty proteins by breaking them down. For unknown reasons, cells (particularly brain cells) sometimes fail to use this mechanism. Rather than breaking down, the faulty proteins accumulate in the cell and form clusters (aggregates). The formation of faulty protein clusters in brain tissue characterizes diseases such as Huntington's and Alzheimer's.
Huntington's disease is an inherited, degenerative disorder that affects physical, cognitive, and behavioural functioning. With the discovery of the gene responsible for Huntington, scientists are now able to genetically diagnose the disease before birth. Current research attempts to make use of embryonic stems cells to regenerate tissue, to repair and heal organs.

Form Workshop

Target group 15 years and up

Introduction Through stem cells we can examine and understand the basic development process of a human embryo and study the tissue regeneration mechanisms of adults. With this





knowledge in hand, we can also learn more about mechanisms responsible for the abnormal development of tissue, birth defects, and cancerous diseases. It is the hope of scientists that this understanding will lead to innovative approaches to diagnosis and treatment, and to the discovery of new drugs.

The participants in this workshop will learn about Huntington's disease and its characteristics; about the procedure for deriving embryonic stems cells for research. They will observe embryonic stem cells and embryoid bodies and will conduct laboratory experiments in this area of research.

Ingredients

- 5 110x magnification microscopes
- Instruction microscope with a 20x objective (final magnification 220x), connected to a display screen
- A display screen
- 5 various-sized latex laboratory gloves (without talc)
- 5 plastic trays
- 6 pipettes, 100µl to 1,000µl volume
- 1 10µl pipette
- Pipette tips
- 96-well tray
- Microtube test tubes, one for each tray (8 in total)
- DVD with 5 short films (about Huntington's disease)
- Small lump of modelling clay
- Laser pen
- Questionnaires (one for each participant)
- Pencils

Presenters

- 1 instructor
- 1 scientist

Preparations

The stem cell specimens to be used must be stored in a refrigerator. They must be brought to the lab before each activity and returned afterwards.

Procedure

Introduction: Case Study (5 min.)
The instructor stands before the group, kneading a lump of modelling clay. He gives each participant a piece of clay asking him or her to create something in about 30 seconds. He then displays the final projects on the countertop. In recent years, researchers have discovered a way to do something similar in the natural sciences. Show the first part of the film (Film 1) about a victim of Huntington's disease. The film excerpt ends with speculation about the PGD procedure and the hope for its success.

Film 2: PGD Procedure
The patient in the film tells us that a procedure called "PGD" was recommended to him and his wife. What is this procedure?

Film 3: Screening of the IVF film
As nature has it, a woman's ovaries produce one egg per month. To improve her chances of becoming pregnant when it is difficult to do so naturally, she is given medication to stimulate her ovaries to produce more than one egg, which can later be retrieved and fertilized outside her body. A second type of medication is injected to help the eggs mature and about 35 hours later the eggs are retrieved.

Film 4: Short Film on Cell Retrieval
The film shows the process of extracting a cell specimen from the embryo for genetic testing. The observation is made under a 400x magnification microscope.

Film 5: Screening of the final part of the film
Approval is given to use abnormal embryos for research.

Stem Cells
The instructor asks: What does all this have to do with stem cells? If a person has a problem stemming from damaged neurons, why not just extract those neurons and try to work on them to develop new drugs?

After receiving embryos from the donors, the researcher grows them for five days on a

plate inside an incubator until they reach the blastocyst stage (in which dozens of cells have formed). At this stage, space begins to separate the embryonic cells (which appear as two layers of cells inside a fluid-filled sac), and the cells are differentiated to take on specific roles. The cells surrounding the embryo will develop into the placenta; the inner cells (called the ICM, or inner cell mass) are the ones of interest to stem cell researchers.

The instructor shows a photograph of a blastocyst.

Manipulation stage
The scientist retrieves cells from the ICM and grows them on a bed of fibroblast cells, which serve as an adhesive and secrete nutrients for about a month. The retrieved cells are embryonic stem cells, which have two characteristics that make them unique:

1. They are still "neutral" cells whose identity and function in the body have yet to be determined. Therefore, they can be assigned an identity and function and turned into any type of mature cell – a skin cell, a muscle cell, a blood corpuscle – and produce new cells that rehabilitate tissue and organs.
2. They are able to divide and multiply without limit, forming identical new cells. In this way, they maintain a constant bank of undifferentiated embryonic stem cells (that have not attained a final purpose or identity).

Microscopic observation
The screen of the instruction microscope will display a 3D culture of embryonic stem cells (a single cell layer) mounted on a fibroblast bed. The participants divide into small groups; an equal number of participants at each microscope. The scientist will guide the observations of mounted embryonic cells.

Scientists today know how to turn stem cells into cells of different types: heart cells, blood cells, nerve cells, etc.
The instructor asks: What cells of the body can you name?

The instructor presents three cells that originated as stem cells: beating cells (Film 5), blood cells, and neurons.

Screening Substances for Reactions (15 min.)

Five groups of up to four participants each will conduct this activity.

The instructors must fill the scanned wells with an iodine solution (approx. 100 µl in each well). The participants will receive test tubes (equal to the number of wells), some containing different concentrations of starch and some containing water. These will be described as substances with therapeutic potential and each tube will be labelled by a number or by the name of the fictitious substance. The participants will be briefed on the use of pipettes and the location of their assigned wells. They will calibrate the test tubes with 50 µl and transfer that volume from each tube to each scanned well. The participants will observe the changes in colour and record the results after comparing them with standard colours presented to them.

Synthetic Biology

By Cambridge Science Festival (UK)
& INRIA - Institut National de Recherche e
n Informatique et Automatique (France)

www.admin.cam.ac.uk/sciencefestival/index.html
www.inria.fr/inria/index.en.html

The science behind the presentation

Synthetic biology means artificial or man-made biology. Synthetic biologists use engineering principles to create novel biological systems with functions that are not found in nature. In the future, synthetic biology could create microorganisms, which can eliminate toxic waste from contaminated soil, create plants, which will have greater nutritional value to be grown in developing countries. And biologists and engineers may be able to create biological tools, which can detect damage in our blood vessels and repair them. The public has a limited exposure to what the goals and processes in synthetic biology are, and this must be changed. This project illustrates how genes can control the overall architecture of an organism and how varying their combinations can affect this structure in different ways.

Form Workshop / Exhibition

Target group All ages

Introduction Synthetic biologists draw on engineering principles to create new biological systems that are not found in nature. It is believed that in future, synthetic biology can create microorganisms capable of eliminating toxic waste and plants with greater nutritional value.

This workshop/exhibition will involve and engage the public by presenting a kit for gene construction to build plant species and control cell proliferation. A model of a flower controlled by genes is created. Posters show information on flowers and their organs; What a gene is and how genes control organ identity. A software demonstration makes it possible for people to switch genes on and off and run the results, which alters the geometry of the flower organ and the number of organs (petal, sepal etc).

Ingredients

- A computer demonstration/ software programme where people can switch genes on and off and run the results
- Posters
- A PowerPoint presentation

Presenters:

- 2 lead scientists from the partner institutions

Preparations

Make posters with information on flowers and their organs: What is a gene, how does genes control organ identity etc.

Prepare the computer demonstration

Procedure

A 45min presentation is offered to visitors interrupted by several demonstrations illustrating how computer science can be used to create and explore “virtual flowers”. This presentation can be repeated many times during a whole day.

The Better Brain

By Agadem (Sweden) &
Wissenschaft-im-Dialog (Germany)

www.agadem.se
www.w-i-d.de

The science behind the presentation

Scientists have long thought that the number of nerve cells in the brain does not change much. But over the last ten to twenty years they discovered that new nerve cells are created from 'neural stem cells' during a human's lifetime. The latest research wants to understand how this enables the brain to repair itself in case of disease or following injury, and find what supports this process. It has been shown that physical exercise; a healthy diet and stimulating surroundings are among the most important factors, which help to keep the brain in a condition to support this growing and repairing of brain cells.

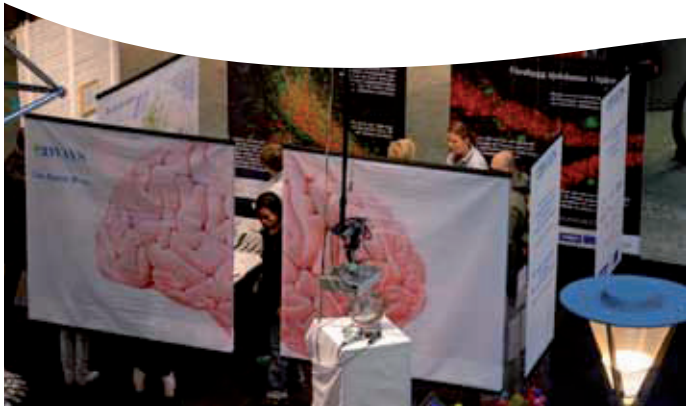
Form Exhibition

Target group Students and adults

Introduction The presentation focuses on the importance of "enriched environment", which includes physical activity and diet as therapeutic stimulators of stem cell activity and brain repair. It has been proved that exercise, food, and environmental stimulation are among the most important factors in modern neurone rehabilitation.

Ingredients

- A room of 15 m^2 (down to 10 m^2 is possible, but may be very tight)
- 5 main banners, 170x170 cm, illustrating key functions of the human brain (with



short key messages focusing on the importance of diet and exercise) 1. Change your brain, 2. Improve your brain's capacity, 3. Smart Aging, 4. Prevent Brain Diseases, 5. The good choices

- 5 "external" banners (facing out of the workshop stand) with additional information (the banner may display huge images, e.g. featuring a pink coloured brain in order to attract attention)
- A dinner table with 8 plates with (pictures of) different food + explanations underneath the plates.
- Additional plates and tableware to make it look nice and homely (e.g. a bowl of berries and fruit)
- A bar table
- 2-3 stools
- 3 transparent plastic boxes
- Coloured plastic balls.
- Handout folders with information about each of the pictures and some general advice on how to be good to the brain.

Presenters:

- 2-3 presenters (preferably researchers or PhD students familiar with the subject)

Preparations

- Make the 10 banners
- Create the exhibition space hanging the 5 main banners from the ceiling, forming a square room for the visitors to enter.

- Display the "external" banners so they are visible from a distance.
- Inside the exhibition place, one primary exhibition, one smaller exhibit/discussion corner
- In the primary exhibition, place 8 plates of various foods (pictures) on the dinner table. Underneath the plates, place some brief texts about how the various types of food influence the health of the brain, e.g. hamburgers, salmon, other fish etc.
- Create a "bar corner" – a smaller exhibit area – with tables and bar stools. This room is meant to engage visitors in a dialogue with the researchers.
- The 3 boxes and coloured plastic balls constitute a simple survey voting system. The question asked could be "From what you have learnt here, will you change your diet and exercise habits?" On one plastic box you write: "Yes", on another plastic box: "No – I'm happy as it is", and on the last box: "No – I'm already doing what you suggest". Then the participants put a coloured ball in the plastic box that suggests their answer.

Procedure

The workshop and exhibition could run over several days; during a conference or similar.

Variations

Set up an area with a "Science Café" with the research group leader elaborating on the subject with in-depth discussions and dialogue with the visitors. The visitors will have the opportunity to sit down and meet with senior scientists in a relaxed setting for more detailed presentations and discussions, including discussion among the visitors themselves.

It's a good idea to make more information in the field of science available on a website.

Comments

External banners:
If the exhibition is to be used in a regular exhibition stand or booth with walls then the external banners may be superfluous.

It is important to make a clear entry zone so that visitors do not hesitate to enter.

The discussion/bar corner:
In order to facilitate the introduction, samples of rat brains in plastic tubes may serve to generate questions for the starting point of a discussion.

The visitor survey:
The survey is of course a highly unscientific survey: Not all visitors vote, some interpret the questions in their own way, some cheat and use more than one ball etc – but it provides an opportunity to measure the effect of the exhibition.

The Complexity Experience

By ETH Zürich (Switzerland)
& International Science Festival Göteborg (Sweden)

www.goteborg.com/default.aspx?id=8691
www.ethz.ch/index_EN

The science behind the presentation

Systems biology is an emerging scientific field with many challenges and, as a way to improve the understanding of the human being, it is expected to have profound impact on medical practice and therapies. Systems biology has an approach to consider the whole organism, consisting of the examination of the structure and dynamics of cellular and organisms function, rather than the characteristics of isolated parts of them. The behaviour of the system as a whole cannot be explained by its constituents alone. Systems biology involves the integration of diverse quantitative experiments with simulations of dynamic mathematical models to try to represent biological models.

Form

Exhibition

Target group

12 years and up

Introduction

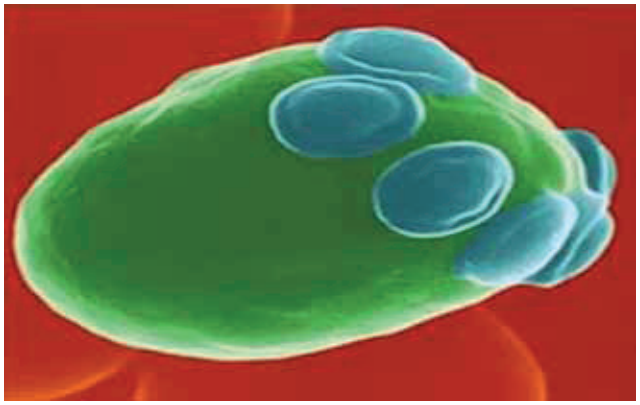
Systems biology is a rapidly emerging field of research having a holistic approach to understanding biology at a system level. This means an examination of the structure and dynamics of cellular and organismal functions, rather than focusing on the characteristics of isolated parts of a cell or organism.

Ingredients

- A room of 15 m^2 (down to 10 m2 is possible, but may be very tight)
  4 main banners, 170x170 cm, illustrating key functions of the human brain (with short key messages focusing on the importance of diet and exercise) 1. What is Systems Biology; 2. Modelling using yeast;
  3. Treatment for Alzheimer's?; 4. European Collaboration
- A table with a game illustrating the complexity of dynamic mathematical models; in this case a simple "city mat" (like children use in kindergarten) was used as a metaphor for the interdependence when choosing between different pathways ("streets")
- A bar table with 2-3 stools
- Handout brief information about System Biology.

Presenters:

- 2-3 presenters (Preferably researchers or PhD students familiar with the subject)



Settings:
The presentation (could) consist of two parts:
1. An interactive and dialogical exhibition, open with staff during 3 days
2. A Science Café with the research group leader elaborating the subject with in-depth discussions and dialogue with the visitors

Preparations

- Design (or translate) and print the banners
- Create the exhibition space hanging the 5 main banners from the ceiling, forming a square room for the visitors to enter.
- Display the "external" banners so they are visible from a distance.
- Inside the exhibition place, one primary exhibition, one smaller exhibit/discussion corner
- In the primary exhibition, arrange the game area/table in such a way that it invites to participation with an explanation role/position for the presenter.
- Create a "bar corner" – a smaller exhibition area – with tables and bar stools. This room is meant to engage visitors in a dialogue with the researchers.

Procedure

The presentation can run continuously over one or more days, depending on the availability of staff. Specific activities, like a Science Café or similar, can be arranged in connection, preferably both in time and regarding location (e.g. in the same building or near by).

Variations

Set up an area with a "Science Café" or similar where visitors have the opportunity to sit down and meet with senior scientists in a relaxed setting for more detailed presentations and discussions, including discussion among visitors.

It's a good idea to make more information in the field of science available on a website.

Comments

External banners:
If the exhibition is to be used in a regular exhibition stand or booth with walls then the external banners may be superfluous.

It is important to make a clear entry zone so that visitors do not hesitate to enter.

Travelling through the world of biomaterials

By The University of Latvia
& Edinburgh Science Festival

www.sciencefestival.co.uk
www.lu.lv/eng

The science behind the presentation

A biomaterial is essentially a material – natural or man-made – that is used and adapted for a medical application. New knowledge about biomaterials can be used, for example, with regard to bone replacement and bone implants. Ceramic biomaterials are widely used in medicine and biotechnologies. They form a coating for bone and dental implants, serve as substrates for cells working in bioreactors. For such applications, interaction between cell and ceramic surface is crucial.

Form

Workshop

Target group

All ages

Introduction

The presentation focuses on introducing biomaterials as part of our daily life. The key points are to communicate findings and more generic features of the biomaterials and to show how natural resources can be used to benefit society.

Interactive stations serve to create a journey through a world of biomaterials. A visual decoration is used in order to invoke the feeling of a journey. The visitors will travel through the world of biomaterials hopping on and off at the different stations.

Ingredients

- Petri plates
- Yeast cells
- Hotplate
- Curdled jam
- Bubble-counter
- Plastic material to create artificial bones
- Projector

Presenters:

- Young Scientists

Procedure

The world of biomaterials consists of three different stations:

1. Painting with yeast

This station is an opportunity for visitors to paint with yeast cells on Petri plates. Invisible in the beginning, the paintings will become visible when the yeast cells start to grow and proliferate (it happens right after the yeast is in contact with the Petri plate containing full broth). It takes about 1,5 days for a "full picture development" on the plate. The visitors are supposed to take the Petri plates with them, thus keeping a small present from the journey.

2. The secrets of fermentation

Related to the painting with yeast, this station demonstrates fermentation and must be carried out in two different ways. First by visualizing the processes in the yeast cells with a projector on the wall. Secondly, a more practical approach demonstrates fermentation by means of curdled jam. The jam must be warmed up by a 'simple distillation device' to show how homemade liquor can be made. Additionally, the bubble-counter is used to reveal the intensity of the fermentation within different jams.

3. Make a bone

The human bones are an alternative theme within the presentation. This activity illustrates how bone implants made from hydroxyapatite are used in practice; video footages from real operations must be used to illustrate this fact. After the video footage, visitors (especially children) are invited to make bones from a special plastic material that hardens when put into a microwave oven. A skeleton may support the bone making offering easy access to copy one specific bone.

Comments

To communicate with children, you have to emphasise the interactive elements of the presentation (i.e. station 1 "Painting with yeast" and 3 "Make a bone")

Students are very interested in "the secrets of fermentation" station.

Vaccine safety
– vaccine benefits

By Università della Svizzera italiana (Switzerland)
& Jardin des Sciences (France)

www.usi.ch/en
www.unistra.fr/index.php?id=unistra_en

The science behind the presentation

Vaccines have been extremely successful at controlling diseases that used to be among the leading causes of death for children. However, changes in public perception have led people to reject vaccines resulting in deficiencies of the immune system in many people and to an increase of diseases in many developed countries. In addition to this, concerns about vaccine safety have increased, largely fuelled by misinformation. Paradoxically, the success of vaccination in preventing some diseases has made fear of the same diseases diminished although the risks of exposure persist. The public must be confident that vaccines are as safe as possible; that their benefits outweigh the risks and that the vaccine programs are in place to ensure the safety.

Form Workshop / Exhibition / Game

Target group Students

Introduction This workshop/exhibition/game wants to make students aware of the historical and scientific aspects of vaccines. The goal is to bring them to a constructive dialogue about vaccine safety and benefits.

Ingredients

- 4 rooms per class (of 20 pupils)
- 3 moderators of which 1 is a scientist
- A questionnaire with general questions concerning vaccines.

- 13-19 information panels (about vaccine and diseases)
- A video projection (to be found at www.wehi.edu.au). The video needs to be cut and the audio translated and adapted.
- A “Play decide” kit (to be found at www.playdecide.eu)

Preparations

Set up an exhibition with information panels and video projection and 3 separate rooms for the discussions.

Procedure

The students’ opinions on the topic are investigated at the very beginning by means of a questionnaire.

A scientist tells the students about vaccines and diseases with the help of the information panels presenting the history, the functions, and the core aspects of the diseases and their vaccines.

The video projection shows a short film (5 minutes) concerning the functioning of the immune system and then the history and function of vaccination.

The play: Playdecide

In the play, students read histories, facts, and problems related to the theme of vaccine in their country and at the end of the debate/game they democratically have to decide the role of the State concerning vaccine: Should it dictate citizens to be vaccinated or should it just recommended it?

I VACCINI

1. **Ritieni di conoscere come funziona un vaccino? (Che cosa è iniettato, come reagisce il corpo, quali sono le possibili conseguenze, ecc.)**

Sì, molto bene	Sì, abbastanza bene	Poco	Per niente

2. **Attraverso quale canale hai ricevuto informazioni in merito ai vaccini?** ***(più risposte possibili)***

Famiglia		Media (TV, giornali, radio)	
Medici/Ospedale		Internet	
Scuola		Altro:	
Amici			

3. **Sei favorevole o contrario alle vaccinazioni in generale?**

Favorevole	Abbastanza favorevole	Indeciso/a	Abbastanza contrario/a	Contrario/a

4. **Quale termine associ a "vaccinazione"?** ***(max 3 risposte)***

Prevenzione		Inutilità	
Paura		Lotta alle malattie	
Solidarietà		Protezione	
Business farmaceutico		Altro:	

5. **Immagina di non essere vaccinato/a. Ti propongono queste vaccinazioni, sulla base delle tue conoscenze, quali faresti?**

	Sì	No	Non saprei, non ne so abbastanza
Difterite, Tetano, Pertosse (DTP)			
Hib (Meningite)			
Poliomelite			
Morbillo, Orecchioni, Rosolia (MOR)			
Papillomavirus (HPV)			
Epatite B			
Varicella			
Influenza			
AIDS			
Colera			
Peste			

Scuola: .....

Classe: .....

Età: .....

Sesso: **F** ☐ **M** ☐

Wonderfood

By AHHAA Science Centre (Estonia)
& Andalusian Society for the Dissemination
of Science (Spain)

www.ahhaa.ee/en
www.cienciacompartida.org/index.php

The science behind the presentation

Our organism has a defensive system called the immune system that protects us against germs that invade our body and makes us sick. The immune system produces antibodies – a very efficient weapon that helps the body fight back at these germs. However, sometimes our immune system has insufficient time to produce these antibodies required to respond to some infections. Researchers have found that they can work with a healthy bacterium called Lactobacillus to assist in fighting these infections. They have developed a technique that enables them to obtain Lactobacillus capable of producing antibodies against germs in the belly. These Lactobacillus bacteria can be used to prevent these infections. Just eat or drink something special containing the valuable and healthy culture of Lactobacillus.

Form Workshop

Target group 12 years and up

Introduction This workshop will explain and show how the immune system works.

The lactobacillus bacteria will be observed and explained by using a microscope. A presentation will show the process that is being developed to genetically modify these bacteria so that they can protect our body against some specific pathogens.

Ingredients

- 6 pieces of PLAYMAIS (pieces of coloured corn that can be stuck together by wetting their extremes) in one colour
- 2 pieces of PLAYMAIS in a different colour

Preparations

The presenter of the workshop must guide the visitors through the workshop and explain the basic ideas of the immune system before the workshop starts.

Procedure

The workshop

The visitors build an antibody using:

- 6 pieces of PLAYMAIS of one colour:
- 2 pieces of three different colours:

Antibodies are proteins typically made of basic structural units. They have two large heavy chains and two small light chains.

Though the general structure of all antibodies is very similar (represented by the green and pink pieces), a small region at the tip of the protein (red and blue pieces) is extremely variable and these regions are different and specific in every antibody and will lock onto specific antigens.

This antibody can only neutralize the specific antigen that induced our body to produce it. Pathogen models can also be built using coloured pieces of PLAYMAIS. The recognition of the antigen by the antibody can by represented by pieces of the same colour put together in the pathogen and in its appropriate antibody. These pieces must be placed together in the variable regions of the large and small chains of the antibody.

Observing the Lactobacillus bacteria

After visitors know how the immune system works, the presenter explains what a passive immunity is and what Lactobacillus bacterium has to do with it. Visitors can observe Lactobacillus bacteria using a microscope. Bacteria preparations can easily be obtained from commercial suppliers.

Finally, the presenter explains which processes scientists are developing so that these bacteria can produce passive immune response.

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