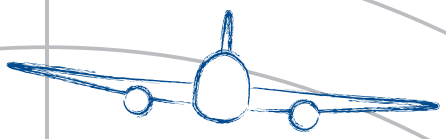
Klett MINT

DFS Deutsche Flugsicherung

FLIEGEN

Lerneinheiten für den Fachunterricht
in der Oberstufe



KAPITEL 13

Bilingualer Unterricht

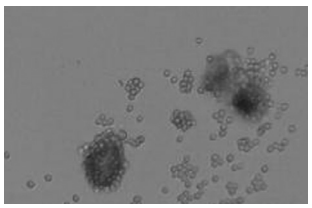
Biology

- Biology of Flight
- Bird flight – the greatest air show on earth
- Insects as flying sex ambassadors
- Maple and Co. – flying acrobats
- Pollen flight – sex tourism in the plant kingdom?
- Air-borne spore dispersal

Human Factors

- Human Factors – career capabilities
- Mutual respect and disregarding your own feelings
- Human performance
- Body language – self-assurance – resilience
- Stress management

13.1 Biology of Flight



Mould spores

Birds fly through the air. Insects fly through the air. But does anyone sing about hazelnut pollen? Or birch seeds? Hardly. Just the same, this type of flight deserves to be examined just as carefully as the majestic flight of an eagle or an albatross.

It does not matter whether it is an animal or a plant: for millions of years now, nature has been using design principles which form the basis for amazing feats of flight and which are now found in modern aircraft construction. For instance, the unimposing birch seed is a paradigm for lightweight construction with a small body and large wing areas, giving it excellent flight characteristics. So the true pioneers of flight were not Montgolfier, the Wrights or Lilienthal, but mould spores, dandelions, dragonflies and hummingbirds, to name just a few.

Dandelion

As we will see, the topic of flight provides a fascinating foray through the realms of biology and is by no means restricted to ornithology – even though the achievements of migratory birds are amazing.

Biology also provides answers to the “why” of flight: it not only makes individual rapid locomotion possible (birds are one example), but also enables air transport of goods over vast distances – although the “goods” in this case are not suitcases and boxes, but embryos, germ cells and spores. Many plants have developed refined strategies, such as clearly marked landing areas, that help them to spread their genes over considerable distances. Insects are an example of this form of air transport and are rewarded for their work with sweet nectar.

Butterfly

The following learning modules allow us to obtain a better understanding of the biology of flight with the help of numerous experiments and observations.

Black-headed gull

13.2 Bird flight – the greatest air show on earth

Gliding, swooping, wheeling, hovering, landing with diving into water, taking off from water – the best pilot in the world comes nowhere near the flying skills of a bird. In this learning module, we will look at the biological imperatives underlying bird flight. The physical aspects are described in detail in section 7.

Hummingbird hovering at a blossom

Wingspans
Hummingbird: 12 cm
White stork: 225 cm
Albatross: 350 cm

Wingbeats per s (max.)
Hummingbird: 50–200
Sparrow: 10
Kestrel: 5
Swift: 12

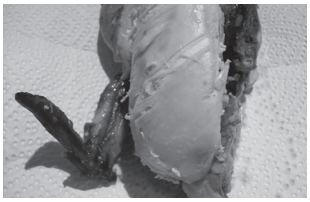
Flying speed in km/h
Sparrow: 40
Kestrel: 75
Swift: 130

Task 13.2.1

A roasting chicken on the dissecting table • The "propulsion unit" of a bird is its flight musculature which moves its wings in such a way as to provide both lift and propulsion – and here it differs significantly from an aircraft. The economical lightweight construction includes not only the feathers ("wing material"), but also the supporting structure, in other words the skeleton. We do not need to sacrifice an eagle or an albatross to investigate the anatomical details: half a roast chicken from a food stall will do nicely as a specimen.

Materials: wash bowl, scalpel, half a roast chicken
Procedure: first the skin is removed completely and the layout of muscle groups is documented with drawings or photographs. The large breast muscle is dissected away with a sharp knife, starting from the carina (keel bone). The muscles (in other words the meat, including the small breast muscle) also need to be stripped away from the thighbone.

a| Describe the position, size and function of the breast muscles and the carina, as well as the opposing movements of the wing.
b| Cut a section of the thighbone of the chicken, describe its structure and explain how it relates to the flight capacity of the bird.
c| Describe the wing position and movements in gliding and flapping flight.

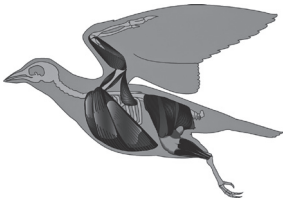


Breast muscles of the hen

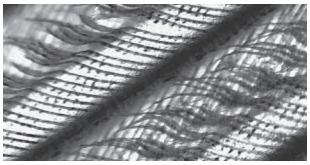
Task 13.2.2

Examination of bird's feather • Materials: magnifying glass, microscope, set of scales, feather (approx. 15 cms long), cardboard
Procedure: the mass of the feathers and a piece of cardboard of similar size are determined for comparison. The feather is examined under the magnifying glass and the microscope at various magnifications.

a| Using your fingers, check the cohesion of the parallel barbs of the feather.
b| Draw barbs and barbules and describe their function for the wing.
c| Give reasons for the difference in mass between feathers and cardboard strips.

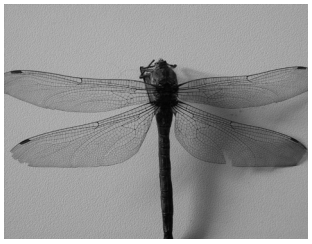


Breast muscles of the dove



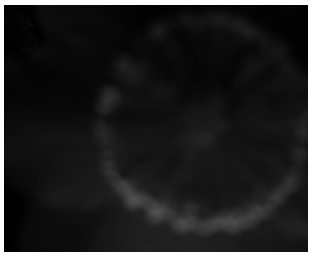
Barbs and barbules of a feather

13.3 Insects as flying sex ambassadors



Dragonfly

Flying insects are of interest to our "flight" topic for two reasons: they achieved flight long before the birds, and they also have a unique cooperation with many plants: they transport germ cells in return for nectar, which is a bargain with reciprocal benefits. This does not apply to all insects but it is a useful arrangement for quite a number of species. Many flowering plants even use fluorescent markings to show flying insects where they should land. The way the wings function is also interesting, because they have no intrinsic muscles: they are moved passively by changes in the shape of the thorax, which contains longitudinal and transverse muscles. These produce the horizontal and vertical movements of the wings.



Blossom in normal light and in UV light

Task 13.3.1

Different kinds of wings • Materials: flying insects from the biology collection (e.g. dragonflies), microscope, cardboard, glue, scissors

a| Examine insect wings under a microscope (lowest magnification) and identify differences between these and the wings of birds.

b| Collect additional information on the topic of "indirect wing movements" and construct a simple model to illustrate it.

Task 13.3.2

Glowing runways • Materials: fresh flowers (preferably yellow) of various insect-pollinated plants, UV lamp, microscope lamp

Procedure: In a darkened room, the flowers are first exposed to UV light and then to visible light.

a| Draw some striking flower markings that become visible under UV light.

b| Find some information on the spectrum of light and the colour vision of bees.

Task 13.3.3

Bees as cargo planes for pollen • Materials: wild flowers, magnifying glass, camera with macro function, brushes, microscope, honey from a particular species of flowering plant ("single-flower honey", e.g. rapeseed honey)

Procedure: observe how bees fly to flowers outdoors. For an analysis of the honey 1 g honey is diluted with a little water and a drop of the solution is placed on a glass slide for observation under the microscope.

Bees pollinating

a| Photograph the pollen baskets of honeybees flying to and from the flowers.

b| Use the magnifying glass to look for pollen on the stigmas of flowers that have been visited. Compare this under the microscope with pollen grains from the stamens of the same plant species.

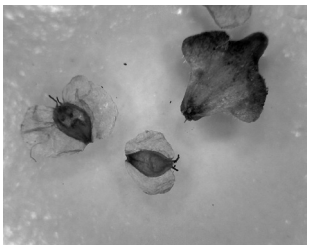
c| Estimate the proportion of foreign pollen in the single-flower honey that you have examined.

13.4 Maple and Co. – flying acrobats

Numerous flight movements can be seen from August to October amongst maples, lime trees, birches and other trees. Maple and lime seeds fly through the air like helicopters, while birch seeds glide vast distances in their thousands, over 300 km has been reported. The bright red berries of the mountain ash are scattered further afield by birds which excrete the hard kernels some distance away.

Flying seeds from maple, lime and pine trees

Conclusion: one can hardly accuse plants of of being uncreative in their exploitation of the air for their dispersal. Mankind has learned a great deal from them. A separate branch of science, bionics, incorporates biological construction principles into technical products. For example, the bows of modern ships imitate the dolphin's beak, while the grooves in some aerodynamically efficient surfaces replicate the "riblets" of shark skin.



Birch seeds with "hangar" (fruit scale)

Task 13.4.1

Experimental flights with screws and discs • Material: fruits of maple, lime, birch, pine, poplar, dandelion etc.

Action: collect fruits, then draw or photograph them. The height of the classroom is sufficient for flight tests using limetree seeds, poplar and dandelion, but then use a window on the first or second floor for other tests (see box). The flight trajectories can be documented very clearly using a video camera with a large zoom area.

a| Ascertain the rate of descent of the different fruits and their range.

b| Describe relationships between the structure of the respective fruit and its flight performance.

c| Compile information on the means of bionics for aircraft construction.

Sure Start
The flying seeds are put into a PVC tube about 2 m long and 4 cm in diameter, and one end is pushed out over the windowsill. Blow through the tube or tip it downwards, and the seed will be started on its flight without anyone having to lean out of the window.

Task 13.4.2

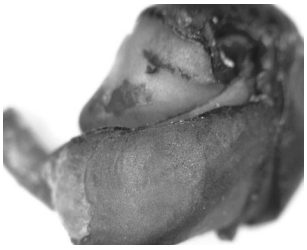
Searching for the passenger • The tough seed coat conceals the seed itself – the part that needs to be dispersed by flight.

Materials: maple seeds, scalpel or knife, dissecting needles

Procedure: the blade is used to remove the tissue (epidermis) at the thickened part of the seed, and the brown, lentil-shaped seeds are cut out. The thin seed coat is also carefully removed. This reveals the plant embryo, which can now be further exposed by careful dissection with the needles.

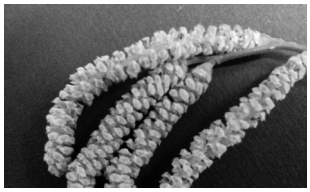
a| Draw the plant embryo. Name its parts and their functions.

b| In the same way, examine the contents of other plant seeds.



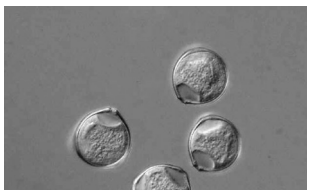
The passenger: a maple embryo

13.5 Pollen flight – sex tourism in the plant kingdom?



Male catkin of the hazel bush

Anyone who is allergic to pollen views the end of winter with mixed feelings, because it marks the start of the next pollen season. Thousands of pollen grains fly through the air and form thick, yellowish layers on window sills and ponds. But the earliest insects rapidly adapted themselves into flying transporters of flower pollen. What is this all about? Pollen grains are male germ cells, and all they are seeking is a female counterpart for sexual reproduction.



Hazel pollen under the microscope

The sun reveals all: A ray of sunlight penetrates a dark room and shows up thousands of dust particles. In spring and summer the majority of this dust is made up of pollen grains.

Pollen from the Internet A good overview of frequent pollen types can be found at: www.pollenundallergie.ch/index.cfm?parentsid=1214

Task 13.5.1

Pollen under the microscope • Materials: brushes, transparent adhesive tape, microscope slide, microscope, methylene blue

Procedure: pollen dust is applied to a slide with a brush and placed under the microscope. Pollen frequency is demonstrated by attaching a strip of adhesive tape to a slide with its contact side facing up and exposing it to the outside air for 24 hours.

a| Examine the pollen grains under the microscope. Stain the pollen nuclei with methylene blue. Make drawings. Pay particular attention to pollen with air sacs (conifers).

b| Classify the pollen grains according to the plants which produced them.

c| Determine the pollen density per square centimetre on the adhesive tape.

Task 13.5.2

Male blossom – a look inside the pollen hangar • Materials: stereo microscope, regular microscope, dissecting needles, male inflorescences (catkins) of hazel or birch (in Spring only)

Note: hazel and birch inflorescences and pollen will keep well in a glass jar sealed with a cloth and rubber bands. This makes you independent of the seasons.

Procedure: the inflorescences are examined with the stereo microscope and then dissected. Individual stamens should be examined under the microscope.

a| Draw and describe the structure of the inflorescence and the individual flowers.

b| Describe the content and function of the stamens.

c| Only for those who are not allergic: release some pollen from ripe flowers by puffing or shaking.

d| Explain why the hazel bush releases its pollen before budding.

e| Collect information on the topic of pollen load and wind pollination. Give reasons in this connection as to why allergy sufferers are evidently unaffected by the pollen of other common plants such as roses or daisies.

13.6 Air-borne spore dispersal

There are more UFO's in one cubic metre of air than most people realise. For example, there are between 100 and 10,000 mould spores per cubic metre of air with even higher counts possible. The effects of mould spores that are invisible to the naked eye can be seen in the development of a mould colony. A week or more may elapse from the time a spore makes a successful "landing" on the appropriate substrate until a visible spot of mould appears, and so the experiment described below must be started at least two weeks before the start of the project.

What are CFUs?
This abbreviation is short for "colony-forming units", that is, those spores or spore clusters that actually germinate. Non-germinating spores are not counted, so the total number of spores in the air is even larger.

Task 13.6.1

Showing the presence of mould spores • Materials: two Petri dishes, spatula, adhesive tape, microscope, water, alcohol, diet jam

Procedure: with a spatula, take samples from a freshly opened jar of jam, and spread evenly in two Petri dishes. Used Petri dishes should be thoroughly sterilised beforehand by wiping them out with alcohol. One dish is sealed with a lid immediately after adding the sample, while the other dish remains open for 24 hours and is then sealed in the same way. Any water lost during this time should be topped up. The experiment is finished when mould growth appears in the first Petri dish.

Transparent adhesive tape is pressed onto the mould spot for microscopy, and then fixed with the adhesive side down onto a slide previously moistened with a few drops of alcohol/water mixture (1:1). Low to average magnifications should be used.

a| Examine mould, sporangia and spores under the microscope. Make drawings.

b| Find out about the structure, biological function, dangers and dispersal of moulds.

c| Explain briefly the function of the jam samples in this experiment.

Mould on a piece of toast with spores and spore carriers (sporangia)

Safety tip
Exposure to spores is reduced by covering them with alcohol and water and some of the germs are destroyed.

SOLUTIONS

Task 13.2.1

a | See illustration “Breast Muscles of the Pigeon”. The large and powerful breast muscle is responsible for the forceful downbeat of the wing, and the small breast muscle is responsible for its upward movement.

b | The bones are thin-walled and hollow, resulting in considerable weight savings. This is also important for the ability to fly.

c | When gliding, the bird spreads its wings out to their maximal wingspan. The air flow is similar to that of an aircraft wing. In flapping flight, the wing’s downbeat increases the air pressure and generates lift. Air resistance is reduced on the upbeat by rotating the wing towards the vertical.

Task 13.2.2

a | The barbs lie close together and can only be separated by pulling hard.

b | See photo “Barbs and Barbules”
The hooklets on the barbules of the feather hook onto the barbules of adjacent feathers like a Velcro fastener, giving a stable and smooth wing surface.

c | A cardboard strip weighs at least twice as much as a feather of the same size and thickness. The reason is the lightweight construction of the feather (e.g. hollow quill and rachis).

Task 13.3.1

a | Insect wings (except for the wing covers of beetles) are mostly transparent and membranous (chitin). Mechanical stability is provided by a network of tracheal tubes that are incorporated into the wing. Bird wings have a load-bearing framework made of bones (vertebrates). The wing surface is formed by overlapping feathers.

b | The basic principle underlying wing movement can be easily demonstrated with a Petri dish, with two plastic strips (“wings”) attached to the rim of the lid with adhesive tape. The inner ends that project into the dish are moved up and down by raising and lowering the dish (representing the floor of the thorax), resulting in alternating “wing movements” like those of a seesaw.

Task 13.3.2

Safety advice for experiment 13.3.2: since UV light is a high-energy form of radiation, looking directly at the UV tubes should be avoided!

a | Flower markings are visible under UV light (as in banknote inspection) even without a UV camera. However, you should do this experiment in a darkened room to avoid interference from stray light.

b | Current senior level chemistry and biology books (topics on colour vision and orientation in bees) are sufficient as basic reference material. Students should identify the wavelength range of visible light and the UV vision of bees, see how these correlate with flower markings.

Task 13.3.3

a | This experiment must be replaced in the winter semester by a film (good video clips on YouTube). Use of a zoom camera is recommended in the open to avoid disturbing the bees, which might otherwise become aggressive.

b | The pollen is easily picked up from the stigma and stamens with a brush and spread onto the slides. Since flowers are certainly visited by different pollinators, pollen from other species (“foreign pollen”) may also be found on the stigma. However, this does not germinate.

c | If too many pollen grains are visible, further dilution with water will reduce the concentration to the point where you can easily determine the proportion of foreign pollen.

SOLUTIONS

Task 13.4.1

a | The rate of descent and the horizontal distance reached depend on wind conditions and are also influenced by vertical updrafts (e.g. over the heated paving of a schoolyard). Velocities for maple and lime seeds are in the region of 0.6 m/s to 1.2 m/s. If the starting point is e.g. ten metres above ground level, one can make a video clip of the flight lasting up to 16 s. If pussy willow or dandelion seeds are available, the rates of descent are even lower (about 0.1 m/s (pussy willow) to 0.4 m/s (dandelion)). The following link leads to an outline of the physical principles of seed flight (especially spiral fliers): www.uni-muenster.de/imperia/md/content/fachbereich_physik/didaktik_physik/publikationen/gefl_gelter_samen.pdf

b | Example – lime seed: the bract of the inflorescence is fused with the peduncle, and is made to rotate by its shape like a rotor, reducing its rate of descent and expanding its range at the same time.
Contrary to what its title might suggest, the article below (available at the URL below) provides information on the flight characteristics and rates of descent of numerous seeds and fruits: www.lwf.bayern.de/veroeffentlichungen/lwf-wissen/34/w34-04-zur-windverbreitung-der-esche.pdf

c | A brief overview of bionics can be found at: www.weltdererfinder.de/?s=bionics&x=13&y=7

Task 13.4.2

a | Two disc-like cotyledons / radicle (embryonic root) / embryonic stem with leaf primordia

b | Good examples here are pulses (peas, beans), because both germ buds and cotyledons are easy to recognise and dissect.

Task 13.5.1

a | Pollen nuclei can easily be stained with methylene blue.

b | Identification guides are needed if the plant of origin is not known.

c | As long as the pollen is evenly distributed, we recommend counting a smaller sector (e.g. 1 x 1 mm) and extrapolating to one square centimetre.

Task 13.5.2

a | and b | Hazel: catkins (male) made up of over a hundred individual flowers, each of which has eight stamens under a bract scale. A catkin (inflorescence) can produce over two million pollen grains in its stamens. These pollen grains are released into the air when the stamens ripen.

c | Shaking can produce a yellow cloud of pollen grains.

d | The leaves of deciduous trees would not be biologically useful as a landing place for many pollen grains, and would block the way to female flowers.

e | Since pollen transfer by the wind occurs randomly and is non-directional, successful pollination must be guaranteed by producing appropriate quantities. This is not the case with insect pollination, since insects such as bees usually fly to plants of the same species and transfer pollen to the stigma at the same time. Plants pollinated only by insects do not appear in pollen level alerts.

Sources e.g. pollen alerts in the weather forecasts of daily newspaper, e.g. www.dwd.de/pollenflug

Task 13.6.1

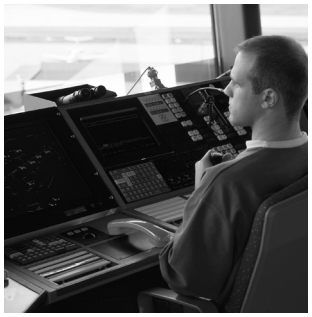
The use of several Petri dishes is recommended (see experiment description), since in some cases brief exposure of the first jam sample may already result in fungal growth. The probability of obtaining the expected result increases with the number of dishes. If mostly whitish, round bacteria colonies form next to the mould spots, these dishes should no longer be used. Dishes will be cleaned by the teacher in hot water and detergent (disposable gloves recommended). Important: very high sugar content can delay or even prevent germination of mould spores. This is the reason that diet jam with reduced sugar content is used.

a | We see hyphae (fungal filaments), sporangia and numerous punctiform spores.

b | Source: any biology books with an overview of the five kingdoms of living organisms. Expected results e.g. function of spores, air dispersal, ecological role of mould as a decomposer (breakdown of organic substances), pathogenic species (e.g. via production of aflatoxins).

c | Jam from an unopened jar is generally sterile, so mould growth in the second sample must originate from spores in the air.

14.1 Human Factors – career capabilities



Flight controllers monitoring airspace.

More than 175 million people take off or land every year at German airports. Their safety is in the hands of the pilots who fly the planes and the air traffic controllers who monitor the airspace. Due to the high level of responsibility, people working in these professions enjoy particularly high standing in society and are paid high salaries.

Working as a flight controller requires continuous high levels of concentration and rapid responses, so it is not surprising that the demands on personal, mental and social competence are particularly high.

Mental performance prerequisites	Knowledge	Personality / Motivation
• Concentration • Vigilance (alertness) • Memory retention • Spatial imagination • Numeracy • Ability to react • Cognitive multi-tasking	• English language	• General motivation • Professional motivation • Balanced personality • Teamwork

Working as a flight controller is a profession for high-school graduates; it is very demanding, but also offers job security and above-average income.

The following learning modules deal with the personal skills (“human factors”) that are generally required for a successful professional career. Using practical exercises, you can test and improve your own skills. We will also use the work of a flight controller to illustrate specific situations in which these skills are required.

Training means practising and improving one’s skills.

14.2 Mutual respect and disregarding your own feelings

It is important for team work (and for other things) that we don't just think of ourselves and our own needs but that we take an interest in our partner and do not try to compete with him as a rival. Thomas Harris' principle "I'm OK, you're OK" is helpful here. Harris described four possible relationships as follows:

I'm OK – You're OK

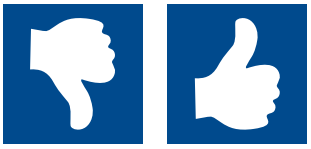
People who think of themselves and others like this can assess situations realistically and make their own decisions independently. They can also assess the results of their decisions and bear the consequences.

I'm OK – You're not OK

If someone has this basic attitude, he is really telling other people what is right for them and what they should do (although these suggestions may not be taken kindly), but he is often incapable of recognising his own problems and solving them.

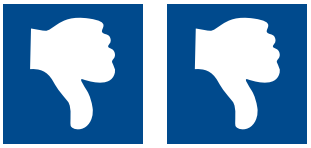
I'm not OK – You're OK

People in this group regard themselves as inferior to others; they have little self-confidence, feel unsure of themselves and are not inspiring partners who one likes to work with. They often acknowledge the achievements of others uncritically and do not give realistic feedback.



I'm not OK – You're not OK

If someone takes this attitude over a lengthy period, he may take little or no pleasure in his work or contact with others – in fact in life in general. Since he is unable to appreciate other people, he isolates himself and runs the danger of sliding into depression or getting other illnesses.



A good way of regarding yourself and others as OK is to use your own initiative (see 14.3 Human performance). This leads to appreciation and genuine interest in our fellow men and women. If I don't put myself under constant pressure to make everything better or more perfect but am still proud of my own achievements, then it is easier for me to acknowledge the achievements of others without envying them.

The idea of describing human relationships in terms of these four basic attitudes is attributed to Thomas A. Harris (1910–1995). He was an American psychiatrist, author and doctor, best known for his book "I'm OK, You're OK", which was published in 1969. This book was a bestseller in the seventies, and its title has been quoted over and over again all over the world.

14.3 Human performance

Spatial imagination
A flight controller operates in a three-dimensional environment in which planes move at high speeds. But the most effective way to illustrate the data is in two dimensions. Aircraft position is indicated graphically as a blip superimposed on the "air map" shown on the radar screen, but the height is shown digitally. That requires a considerable ability to envisage spatial information.

Besides, the instructions on direction must always be correct. This is difficult for the flight controller because he sees flight movements in "plan view", in other words from above. An aircraft approaching from the north and turning left is moving to the right on his monitor.

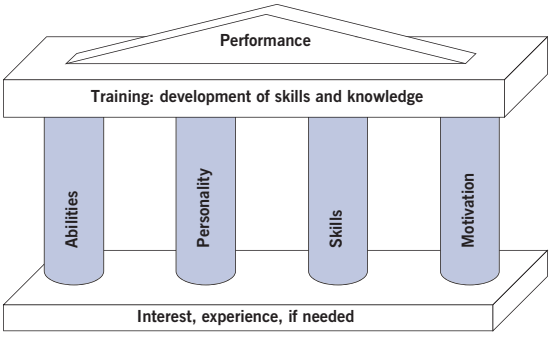
What each of us can achieve (including you as a student), depends on our capability and on our motivation. You can be as brilliant as you like – but if you are not physically capable (e.g. due to illness) or psychologically motivated (e.g. due to reluctance or frustration), your achievement will be well below what one might expect on the basis of your capability. It is therefore important to keep one's level of motivation as high as possible. Curiosity, interest, strong motivation, as well as the ability to put defeats behind you and remain steadfast in pursuing your goals, are characteristics that can help you to achieve a great deal.

Task 14.3.1

Which motivation killers are you familiar with from experience? Strong motivation is important for the ability to perform well and for success, but motivation alone does not guarantee success as we will see with the example of the flight controller.

Task 14.3.2

Look at the following graphic on the characteristics needed by trainee flight controllers and discuss with your neighbour what skills and abilities are required of a future flight controller. What is specifically expected for the three pillars (apart from motivation)?



Suitability aspects

Some of the most important mental characteristics needed by flight controllers (which are examined intensively using aptitude tests), are:

- **Vigilance:** This is the ability to maintain concentration and alertness over a long period. Even if very little is happening (e.g. if there is not much air traffic), it is important to be alert and aware of even minor changes.
- **Multitasking:** This is by far the most important attribute of a flight controller.

Example of multitasking

An air traffic controller works almost exclusively with digital information displayed on monitors and with information exchanged by radio with pilots or by phone with neighbouring sectors. For example, a pilot must "read back" certain instructions of the flight controller (especially if they relate to changes in direction or altitude or altimeter setting). Often the controller is already thinking about the next step after giving an instruction to a pilot (e.g. "clearance"), but must still pay attention to the pilot's "readback"; obviously there could be serious consequences if the pilot misunderstands a course or an altitude. The controller often receives a lot of information simultaneously over the radio. For example a pilot may announce that he has no flight plan, so the controller must then write down or capture electronically all the information on the airport of departure as well as the destination, aircraft type, route navigation etc.

Several aircraft may call in at short intervals e.g. when they fly into the sector or if they request deviations from the allocated route. At that point the controller must note which pilots he still has to answer.

Responsiveness

Apart from making rapid decisions, one must also be able to translate decisions into action rapidly and accurately. Commercial aircraft fly at speeds of around 400 kmh, so a lot can happen in a minute. The controller must be so familiar with the operation of his technical support systems that he could almost do it in his sleep.

Task 14.3.3

Work out your "retention span" in pairs. Each student should write down 20 terms from daily life on a piece of paper. You should then swap papers for 45 seconds and try to memorise as many terms from your partner's list as possible. Write down all the terms you can remember on a fresh piece of paper. Then work out the number of remembered words for the whole course.

Intense concentration, absolute focus on the task in hand and an ability to tolerate frustration are essential prerequisites for success with this test and with training to become an air traffic controller – and for other achievements as well! But even if young people have these qualities, some of them are afraid to make the appropriate job applications, since they are unsure of their abilities or do not have enough self-confidence. Even from people who have landed their dream job, we hear such statements as "I never thought I could do it!".

14.4 Body language – self-assurance – resilience

In general:

- Your body language should be consistent with your character.
- Body and soul should be in harmony.

Body language is enormously important, not just for presentations, oral exams and similar situations, but because it constitutes more than half of the impression you make on other people.

Examples

- It is not consistent if someone cheerfully says: "Things aren't going well for me."
- You do not give an impression of self-assurance at a job interview if your hands are shaking.

Do you believe this little kitten when it says "I know I can defend myself"?

First impressions are important!

When we meet someone for the first time, we form that famous first impression within 150 milliseconds to 90 seconds and decide whether or not the person is likeable or competent.

Behaving confidently: posture – gestures – facial expressions – eye contact

Posture is seen as self-assured if the head, neck and back are upright, with the shoulders relaxed and pulled slightly back. Distributing your weight solidly on both feet gives an impression of strength. If you are giving a lecture or presentation, it may be more comfortable to stand with your legs slightly apart and to shift your weight occasionally from one leg to the other.

If you sit upright and lean slightly forward, you give an impression of calm and concentration. To show that you are interested and involved, lean your upper body a bit further towards the speaker or the table during the conversation. This gives a friendly impression and shows that you have nothing to hide.

Many people use gestures a lot. Fiddling, fumbling and fidgeting show nervousness and uncertainty. Sometimes we don't know what to do with our hands: a pen in the right hand works wonders. You can let your hands hang loose or clasped in your lap when sitting.

A friendly facial expression and an open smile are seen as extroverted (convivial, active, interested) and pleasant. Intensive eye contact (without staring) is essential if you want to appear self-assured and give an impression of self-confidence. Look the other person in the eye, or glance at everyone if you are in a group. This keeps their attention and ensures their support.

Task 14.4.1

Find a partner and take turns to adopt the following postures. Then note how these postures are perceived:

a | Shoulders hunched
b | Raised eyebrows
c | Sitting upright, knees at right angles, hands on thighs
d | Upper body leaning back, legs crossed
e | Upper body leaning far back, head back
f | Upper body bent slightly forwards, eye contact with the person you're talking to
g | Upper body bent well forwards, feet under the chair, no eye contact
h | Upper body bent forwards, hands on the chair
i | Shoulders slumped forwards, hands clasped and feet together, looking at the floor
j | Index finger or pen pointing at the other person

Showing initiative

Are you a perfectionist and seldom satisfied with yourself? Do you sometimes slump your shoulders, bow your head and think: "Oh God, what next!" or: "I hope I can manage to revise everything before the exam!"?

Such negative self-assessments are always an obstacle to success, but this will improve if you work on taking the initiative.

Negative personal statements	Positive initiative
How am I going to do all that?	I'll take this step by step.
I'm definitely going to fail.	I've managed everything so far, so it will go well this time too.
I'm so nervous.	Stay calm, I'll take this slowly.

Examples

If you change your posture at the same time, pull your shoulders back, sit up straight and smile, you are already half-way up the mountain. And if you then relax and deal with issues one step at a time, you will be able to look back and be justifiably proud of yourself and what you have achieved. Armed with this knowledge, try to recall previous situations in which you felt uncomfortable and think about how you would approach them now.

Task 14.4.2

Imagine this situation: you are suddenly called to the blackboard in class and everyone is looking at you. But you are taken completely by surprise by the request, your heart is in your mouth and for a moment you are speechless.

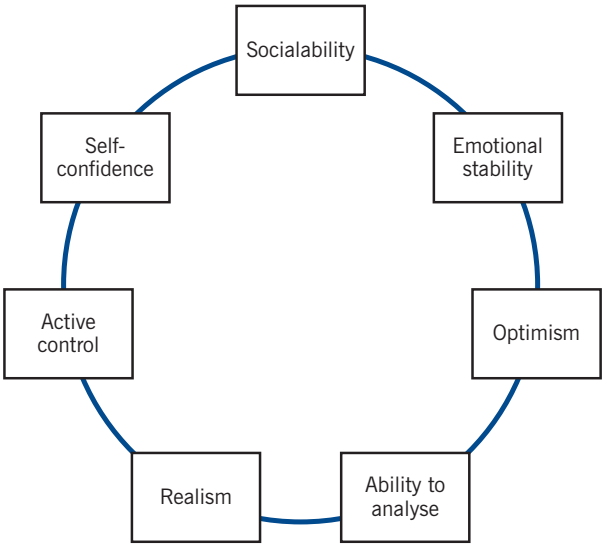
When you do speak you are not satisfied with your comments and blame yourself afterwards, since you could certainly have done better. With two or three good friends, discuss how one could write a new script for this situation so that you are pleased with how you handled it, and act this new version out for the members of your small group. Important: members of the group should regard this as a private matter and treat it as confidential.

Resilience

The term resilience comes from physics and is used in materials science to describe highly elastic materials that resume their original shape after being stretched or deformed. In behavioural science, one is resilient if one has the mental strength to make the most of a misfortune (a crisis, a disaster or "just" major stress), learn from it and grow as a person as a result.

But what happens if you don't achieve your goals due to circumstances beyond your control? This is when you need true resilience, i.e. the mental strength to learn from a "defeat" and carry on, strengthened by experience.

Resilient people know that crises are not insuperable hurdles or the end of the line. They try to find reasons and focus on the possible solutions that they have discovered. The seven qualities in the diagram below will help you to overcome crises successfully and continue with increased strength and motivation.



Seven properties that help one to overcome crises

"Crises are not unusual in people's lives, in fact they are normal"

Bruno Hildebrand, Sociologist, University of Jena

The extent of a person's resilience is shown by his confidence in dealing with an emotional crisis and whether he grows from a painful or difficult experience, and learns from it to deal better with future setbacks. Being a good communicator and having a supportive social environment are essential for this. It is very difficult to overcome life crises by yourself, so cultivate your friendships and develop new ones wherever possible. A good network is always useful – not just when your resilience is challenged.

Task 14.4.3

Discuss the qualities needed for crisis management.

14.5 Stress management

Stress activates a response system in the body that helps it to cope with anything that could be classified as a challenge or threat. It is therefore a vital process that has been essential for survival since primeval times. In seconds it mobilises all energy reserves for maximum performance. Some stress is actually necessary to activate people's physical and mental performance. This level of stress is known as eustress or positive stress.

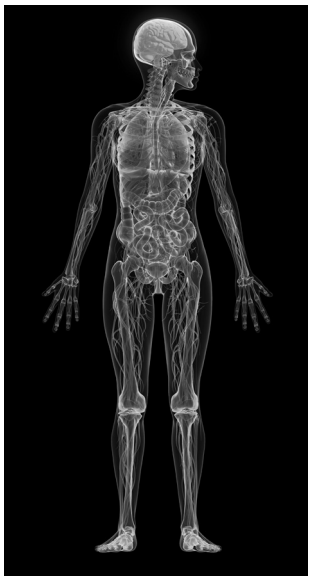
What is stress ?
This is an English word that was originally used to designate tension and deformation of metals or glass. The term was first applied to humans in the middle of the last century.

Stress in flight controllers
A flight controller must constantly keep an image in mind of the current air traffic situation and its future development and then implement his plan rationally and consistently. This means working under stressful conditions for periods of up to two hours. For outsiders a typical high-stress job, but for the controller it means dealing with challenges – positive stress.

It gets difficult for a flight controller when the stress levels get too high. The limit varies and depends on many different factors, including the fitness of the air traffic controller or how he or she is feeling on that day. For example, traffic situations that pose no problem on a normal day may turn into a complex, apparently insoluble problem as a result of stress in his private life. Such a situation can also arise if the traffic suddenly increases without warning to such an extent that there is a feeling of slowly losing control. If the safety of aircraft is actually endangered in a critical situation, any flight controllers involved will be severely stressed. Specially trained "peer helpers" are available who can advise and supervise the controllers when needed to prevent the negative effects of such situations.

Because flight safety is a 24-hour service, a controller must work in shifts, which interferes with natural biorhythms. The human body can cope with sustained stress for some time, but without any countermeasures negative consequences become apparent (usually years later), such as an increased risk of heart attacks or stroke, chronic digestive problems and high blood pressure. This means that relaxation, even during working hours, is very important. Facilities at many air traffic control locations are designed accordingly. Controllers can also attend a health resort at regular intervals and must have regular health check-ups with a flight doctor.

Task 14.5.1
Write down the physiological reactions to danger that you are aware of from your knowledge of biology. The stress reaction was originally vital due to its reflex fight or flight mechanism. The prehistoric hunter fought or fled, depending on the size of the threat, and after dealing with the situation he had time to recover. However, if he was under constant stress due to a continual state



Stress – the body reacts immediately.

of alert, the result was overload and exhaustion – as is still the case for us. Flight controllers try to prevent continual stress by working for no longer than two hours at a time under normal conditions. After that, it is important to relax as quickly as possible.

Task 14.5.2

a| Which stress-related illnesses do you know of?
b| Which options do you know that help you to relax?

Stress is positive at first – it is only when it becomes excessive that we become ill. Typical symptoms of personal overload are intense reactions to minor stress, slow recovery from stress, and early symptoms of stress such as headache, back pain and high blood pressure.

Seven stress factors

One's personal outlook determines what is experienced as stress. For example, many people get a lot of pleasure from riding motorbikes, but for others it is pure stress. Stress is often self-generated!

Task 14.5.3

In which situations at school do certain behaviour patterns create stress? Discuss and write them down.

Ways of avoiding stress

Are you a perfectionist? If so, you can help yourself with positive initiative (see 10.6 Body language and Initiative). Any negativity should be avoided: "I just can't do it!" is reworded as "I can do that step by step!" and then put into effect. If one is very competitive it is often enough to be aware of one's strengths, be proud of them and accept one's weaknesses (see 10.4 Self Analysis). When we are at peace with ourselves, we can accept the success of others without envy and be happy with them. Aggressive tendencies can be minimised by listening in the right way (see 10.2 Team Ability). We can then feel quite differently about comments that used to irritate us.

An illustration of aggression avoidance: your parents are complaining again that you do far too little school work and waste your time on electronic games. Try to see this statement as an expression of caring rather than as a complaint. This will cure your immediate urge to give the waste-basket a good kick.

SOLUTIONS

Task 14.3.1
Possible answers: boredom, lethargy, excessive or insufficient challenge, constant distractions, lack of self-confidence, despondency, stress in other areas, influence of peer group, associated wishes

Task 14.3.2
Possible answers:
Abilities and prerequisites for mental performance: concentration, good memory, spatial imagination, reaction speed and precision
Personality: strong motivation, resilience, confidence, ability to work in a team, stress resistance, constructive approach to failures
Skills and knowledge: English, mathematics, basic medical knowledge

Task 14.3.3
The retention span corresponds to the maximum number of information units (words in this case) that you can retain and reproduce immediately. Healthy adults have a maximum retention span of five to nine information units and most people have an attention span of five to seven units.

Task 14.4.1
Our body language – mirror of the personality
a | Hunched shoulders – nervousness, tension

b | Raised eyebrows – arrogance, statement of speaker is not accepted

c | Sitting up straight, knees at right angles, hands on thighs – calm, attentiveness

d | Upper body leaning back, legs crossed – security, wellbeing

e | Upper body leaning far back, head back – disinterest, rejection

f | Upper body bent slightly forwards, eye contact with speaker – openness, engagement

g | Upper body bent well forwards, feet under the chair, no eye contact – "Get me out of here!"

h | Upper body bent forwards, hands on chair – uncertainty, thoughts of fleeing

i | Shoulders slumped, hands clasped and feet together, looking at the floor – resignation

j | Index finger or pen pointed at the speaker – "Just watch out!" Aggressive threatening gesture

Task 14.4.2
Statements by students in this situation are to be treated as personal and in confidence.

Task 14.4.3
A description of the seven pillars of resilience can be found in Wirtschaftswoche No. 5, 26 January 2009, "Bloß nicht unterkriegen lassen" [Don't let them get you down]. An abbreviated version is at: www.wiwo.de/bilder/trends-bin-ich-krisenfest/4702490.html

Task 14.5.1
Physiological stress reactions:
Brain: the capacity to think and remember is increased, pain sensitivity decreases.
Eyes: the pupils widen to see the threat better.
Heart: blood pressure and pulse rate increase
Lungs: breathing gets more rapid so that the lungs take in more oxygen.
Muscles: Blood vessels dilate to increase energy supply.
Bladder / intestine: digestion slows down to save energy.
Liver, adrenal glands, spleen and blood also adjust to increase the state of alertness of the whole body.

Task 14.5.2
a | Examples of stress-related illness:
Cognitive: reduced performance, lack of concentration
Emotional: depression, "burnout syndrome"
Vegetative / hormonal: cardiovascular symptoms, high blood pressure, risk of heart attack, gastritis, sleep disorders, migraine
Muscles: muscular tension, head, back and neck problems

b | In addition to relaxation options, such as sport and other leisure activities (although these can also be stressful), the three best-known relaxation methods are:
- Progressive muscle relaxation
- Autogenic training
- Breath relaxation

Task 14.5.3
Examples: teacher's impatience with students' answers, arriving too late for exams, etc.