In general the origin of the problems or diseases in the motion system can be
- Congenital
- Tumor
- Inflammation
- Trauma
- Arthrosis (osteoarthritis) = degenerative joint disease
HEAD

Configurations of the cranium:
- narrow in the frontal plane
- wide in the frontal plane
- cephalhaematoma external
- disturbances of ossification, craniosynostosis
The ossification of the cranial bones takes place in a desmogen way; the collagen tissue colony change directly into bone. At the beginning the bone is growing from the ossification center in radial direction and takes a star-like form with toothed edges. The toothed edges come together until the teeth fit into each other. Further on, the bony growth is continued with primer angiogen ossification.
The craniosynostosis is an irregularity of development resulting from the early (premature) ossification of the immovable joints between the cranial bones.
Asymmetry of face and head \leftrightarrow torticollis ?
Can the baby keep his/her head?
The position of the head and its motion will determine basically the development of the posture of human body. One of the main characteristics of human posture and motion is the flexible and balanced control of the head on the top of the vertically positioned spine. The development of head control is also in connection with the development of the three dimensional position of the trunk as well as the stability of spine.
In case of a matured new-born in supine position, the contraction of occipital/cervical muscle moves the head upwards for 1–to 2 seconds; still, it is not a spontaneous raising of the head. Normally, in supine position, the raising of head can be observed from the third week, that is usually associated with movements of the trunk and extremities.
Hypotonic?

In case of functional insufficiency and reduced tone of axial muscles, the head remains leant back and the trunk is bended backwards in lordosis.
THORACIC DEFORMITIES

Etiologic: genetical determination (mesenchyme germ colony)
Dominant or recessive type of inheritance

The excessive growth of the ribs is the dominant factor in the deformity.
Accompanying deformities: Marphan sy., heart-vitium, scoliosis
(The latter shall be distinguished from the consequential deformity of the chest in scoliosis!)
Its forms are:

A. Depressed deformities
   Pectus excavatum
      - central symmetric
      - asymmetric
      - central symmetric + flat back – syndrome
      - asymmetric + flat back - syndrome

B. Protrusion type
   - Pectus carinatum (manubrio-gladiolar- type)
   - Pectus arcuatum (chondro-manubrial - type)

C. Pectus deformatum (longitudinal, one- or double sided)
In the first decade the inflammation of the breathing tubes, the paradox breathing is the most common problem. Between 10 and 20 dyspnea, palpitation, ES occurs, and psychic problems increasing with the age.
Gymnastics. swimming?

Respiration:
- articular and osseous mechanisms
- respiratory muscles (mm.intercostales, diaphragm)
- respiratory assisting muscles
The area of the chest dilates or decreases as the ribs turning around their joint axis. This is the articular and bony mechanism of breathing.
The sternal part of diaphragm is weak, the pars costalis arises from the cartilaginous surface of the last six ribs and is directed upwards vertically and then inwards.
Aspiratory assisting muscles: with fixed arms the thoracohumeral muscles arising from the ribs. M.pectoralis maior et minor, M. serratus anterior, M. latissimus dorsi. Mm. Scaleni, M. sternocleidomastoideus
Conservative treatment can be required:

1. if regression is expected
2. before surgery
3. Postoperative treatment, physiotherapy to improve the posture
4. When surgery is contraindicated
Shoulders falling forwards, accompanying deformity of spine, paradox movement of the frontal wall of the thorax lead to the conclusion that progression exists.

Physiotherapy:
 a) respiratory exercise
 b) muscle strengthening exercise to improve the posture
The respiratory exercise is successful if it shows and exercises how to use the thoracic and abdominal components of breathing separately in a conscious way.

Swimming – provides assistance in attaining the proper and economic respiratory technique.
Figure 12. Abdominal type of respiration
Figure 13. Thoracic type of respiration
Indications for surgical treatment:
- severe deformity
- pectus-index below 30%
- cardiac problems
- impairment of respiratory function
„Pectus- index” : the smallest internal sternovertebral distance (measured on the punctum maximum of the impression) divided by the thoracic transversal diameter (distance between the inner sides of the right- and left walls of the chest (thoracic cavity) measured at the height of diaphragm x 100.

The index above 35% is normal, between 30 and 35% means mild decreasing of the space. In the cases of protrusion type deformities the index is between 45 and 60%.
PECTUS EXCAVATUM

INDEX: \( \frac{A}{B} \times 100 \)

- NORMAL: \( \geq 35\% \)
- MODERATE: \( 20 - 30\% \)
- SEVERE: \( \leq 20\% \)
Problems of the hip and knee-joint in infancy and childhood
The hip—joint is the most proximal element of the kinetic chain of the lower extremity.

In mechanical respect, the hip is the simplest joint—a ball- and-socket joint, where the joint head is the femur head while the socket is the acetabulum. The input plane the acetabulum forms an angle between 30 and 35 degrees with the sagittal plane and an angle between 45 and 50 degrees with the horizontal plane. While the circular fibrous cartilage (labrum) on the edge of the acetabulum encloses the femoral head beyond its equator the hip joint is really an enarthros.
In standing position, the body weight is distributed equally on the two hip joints. Under normal anatomic conditions, the line of action of pressure force passes through the centre of head and is perpendicular to the surface of them. In the stance phase during gait, however, it is only the supporting lower extremity that bears the weight of body and trunk, resp. Pauwels wrote that the weight force of the body acts medially from the hip joint. The lever of body weight is approx. 3-times longer than that of the load that is the lever of muscle.
Consequently, to maintain the horizontal equilibrium of the pelvis a muscle force about three times as much as the body weight is required. The resulting force acting on the femur head is given by the vector sum of the acting forces, that results in a force four times as much as the body weight.
During the intrauterine growth, the hip joint developed in the 10th week old embryo.
The form of the acetabulum is varying from the intrauterine life onwards up to the age 15 – 18. On the first two-third part of fetal life, it is dome-shaped and, then, its depth is gradually decreases and, at the time of birth, the vertical diameter is only two-fifth of the horizontal diameter. After birth, it is further deepened. The completely developed acetabulum takes the shape of a spherical segment of 170 to 175°.
During the development of hip joint, the collo-diaphyseal angle and the antetorsion of the femoral neck are varying. The collo-diaphyseal angle is the angle formed by the femoral neck with the longitudinal axis of the femoral shaft in the frontal plane. The anteversion/antetorsion is the angle formed by the femoral neck with the femur condyles in the frontal plane.
The *collo-diaphyseal* angle is around 120 degrees in the 9th intrauterine month but it increases after birth, up to 150 degrees until the age of 1. It is approximately 140 degrees at the age of 9 and reaches the normal value of 125 to 130 degrees as late as in puberty.
The antetorsion in the 3rd embryonic month is still 0 degree, it varies between 25 and 40 degrees at the time of birth. From this onwards, it is reduced gradually. The value of around 15 degrees typical to adults is developed at the age between 9 and 12.
In Hungary the first orthopedic visit or screening is recommended by the protocol about the sixth week, to measure the maturity of the hip.

In case of normal hip, the Lorenz abduction is 90 degrees, the joint is stable, Graaf I/a with ultrasound.
The ultrasound examination is not equal with an orthopedic visit!
**Unstable hip:**

- Lax hip means usually only the laxity of the joint capsule without the instability of the joint. (Lorenz abduction more than 90 degrees)
- Dislocateable hip, the femoral head can be easily dislocated — usually backwards — under pressure force due to the laxity of the joint. (Barlow symptom)

This phenomenon appears only in the first months.
**Hip dysplasia**
The hip dysplasia means insufficient development of the joint: the acetabulum is shallow, the collodiaphyseal angle is increased as well as the anteversio.

The dysplasia is not a clinical term, instead, it is a radiological one. Clinically the hip is called to be stiff due to the limited abduction.
Luxation of the hip:
Luxatio-repositio occurs while abducted the hip. This is the Ortolani symptom. The congenital hip dislocation has a polygenic form of heredity.
1553 csipőficamos csecsemő születési időpontjának megoszlása hónapok szerint

180 eset

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Hónapok: I., II., III., IV., V., VI., VII., VIII., IX., X., XI., XII.
Wrinkle asymmetry of the tights can relate to hip dislocation, but in fact luxation of the hip can be observed in only 20% of wrinkle asymmetry. If the abduction stiffed one side is associated with constraint adduction on the opposite side, this can also be the consequence of malposition within the uterus.
Treatment:
- hip moving exercises, made by the mother
- “straddling – napkin”
- Pavlik orthesis or abduction device (Pavlik orthesis can be used just until the kid sits up)
- surgical reposition
Different ways of walking
At the beginning of the independent gait kids often step with internal rotated legs on an extreme way, nearly falling through their own feet.
The increased internal rotation of the lower extremity is a normal phenomenon connected with the development of the hip joint especially with the large anteversion angle. 80 % of the children rotating inward, 20 % outward. The internal rotation of the thigh shaft can result in functional knock-knee, when the legs are turned in at knees in the frontal plane.
Beside this often occurs pes adductus, which can be functional as well appearing just while loading, or structural metatarso-adductus. Except the structural metatarso-adductus the internal rotation in the lower extremities will be corrected spontaneously with age. Any of its forms occur; neither of them is pathological, instead, it is some extreme variation of the normal development; no treatment is required.
Limping child

Transitory arthritis

Typical symptoms:
- sudden beginning, usually the kid wake up in the morning refuse to stand on his/her leg
- protective type of limping
- the flexion and internal rotation within the hip can be constrained

Usually bed-rest and Cataflam (NSAR) drops offered; it will improve within 4 -to 5 days.
Arthritis:
- virus origin – in new-born age
- focal origin
- bacterial – propagating always on haematogen way, it gets over from the metaphysis to the joint and not on the contrary direction! Exception: septic infants, those born prematurely
- intermittent, sub-acute – JRA shall be excluded!
- transitory
Night pain of limbs

This is the most frequent complaint in the childhood affecting the motion system. The kid suddenly wakes up crying badly in the night and claiming pain in the leg. Its characteristics are:
- no limping
- no objective motion failure in none of the joints of the lower extremity
- in the morning the kid cannot remember and cannot show the certain place of the pain on the limb or even the side of the painful limb.
The cause is unknown. It differs from pain in the night at a permanently certain bony point.
Perthes disease = osteochondritis deformans juvenilis coxae

Juveniles osteochondrosis or osteochondritis means inflammation of the growing cartilages.

Histologically the juvenile osteochondrosis is a sort of avascular necrosis followed by bony remodeling in the growth period, instead of inflammation. This can occur anywhere within the body in puberty and the histological form is always the same without in account the affected region, but can cause serious deformities remaining for the adulthood in the *hip and in the vertebral column*. 
Symptoms:
Usually the painless limping is the first sign, often without complaint. On the side concerned, only the inward rotation at the beginning and later the flexion and abduction are also limited.

Three phases can be distinguished: the first one lasts until $\frac{1}{2}$ to 1 year, the second - the degeneration phase 1 to 2 years, the third one - the remodeling phase can last as long as 2 to 4 years.
The basic principle of treatment is to keep the femoral head away of loading and the containment. (Make it covered)

Conservative treatment:

- unloading with crutches
- Perthes unloaded walker device (with tuber support, sliding bridle)
- PHYSIOTHERAPY

Operation is preferred only if the head is a priori partly uncovered. (Coxa valga subluxans) On the other hand, the circulation usually improves with surgery; therefore, the progress of illness is mostly accelerated, and the duration will be shortened.
Often, the physician meets the patient as late as the head has already destroyed.

Sometimes both side is affected at the same side. In these cases the Perthes orthesis is the suitable choice for treatment.

The treatment of Perthes disease is an extremely important task for physiotherapists even if lasts as long as for years!
**Epiphyseolysis capitis femoris**

If a fattish child is limping with outward rotated limb and complains of pain in the knee, we shall think on epiphyseolysis.

In fact it is a fracture separation of capital epiphysis or fracture avulsion usually without trauma. The proximal femoral epiphysis slides backward and downward from the neck.
It is more frequent in males (ratio 2:1), it occurs between 13 and 16 in case of boys and between 11 and 14 in case of girls. It is often two-sided even if not at the same time. It is supposed to be due to hormonal disturbances: in case of children of dystrophia adiposo-genitalias constitution, the production of sexual hormones is delayed, the concentration of STH is still high and the epiphyseal growth plate is widened as a result of it.
A typical clinical symptom is the significant restriction of internal rotation and the Drehmann symptom (during the hip flexion abduction and external rotation occurs due to the dislocation of the capital epiphysis)
Epiphyseolysis lenta – acuta

The clinical symptoms can precede the appearance of radiological alteration by weeks. The capital epiphysis slides back and down gradually without trauma.

At the acute cases the avulsion become completed due to the trauma. For the certain diagnosis X-ray is needed: ap. X-ray of the pelvic, to compare the head-positions, and primarily the Lauenstein exp! (hip and knee flexed in 45 degrees each)
**Knee joint**

The knee joint is the joint of the largest size and at the same time the most complicated structure in the human body. According to its mechanism, it is a trochoginglylymus, but according to its structure, however, it is similar to the pure ginglylymus.
During standing and gait, and even bending – that is under dynamic conditions – the lateral- and cruciate ligaments fastens the stability of the joint.

The lateral ligaments span the knee joint along the largest radius of curvature of femur condyles. Consequently, they are stretched to the maximum extent in extended position of knee joint while in bent position they are relatively lax due to the reduced radius of condyles.
In fact, the **cruciate ligaments** are the “inner lateral ligaments” of the knee joint, that origin from the surface of the medial and the lateral condyle facing the intercondylar fossa and pass forwards and backwards. The cruciate ligaments are stretched in each phase of motions, that is, in each position of the knee joint.
It is the common function of the cruciate and lateral ligaments not to enable the pure rolling during the flexion-extension motions; instead, they force the bones to perform simultaneous sliding motion.
As the rolling surface of femoral condyles is four times as long as the motion path of the tibia plato, therefore, 1 mm rolling of the femur condyle on the tibia shall be accompanied by a slip of 4 mm.
The radius of curvature of femur condyles is smaller as that of tibia condyles in both sagittal and frontal direction, thus, wedge-formed spaces left free between the two joint surfaces. These spaces filled with meniscuses. The meniscuses ensure the congruence of joint surfaces in any position.
The characteristics of the form and the function of knee joint as well have been evolved since 300 million years.
Standing on two legs the mass centre of body is at the central line, the loading on the two knee joints is symmetric. Based on the calculations of Braun and Fischer, the knee joints together bear 86.5% - that is 43% each - of the body weight.
Standing on one leg, 93% of the body weight act along the vertical line passing through the mass centre, thus, the knee joint is loaded eccentrically and medially, balanced by the muscle force of the tractus iliotibialis acting laterally. The knee joint is loaded by the resultant of these two forces. According to the calculations of Maquet, it means slightly more than two times the body weight.
A térdizület megterhelése
P = a test sulyereje
L = a lateralis izomerő
G = a térdizület flexios tengelyének centruma
R = az eredő erő
The **genua vara** appears frequently in babyhood and infancy and is usually symmetric. It can be associated with lateral instability; however, it is always free of complaint. Under load, it is usually increased, or sometimes it exists only while weight-bearing. This deformity “heals” or disappears spontaneously with the growth in the majority of cases.
Blount- disease

“Trickling down” and/or widening of medial tibia epiphysis. It is an infrequent disease; however, it shall be considered.
Genua valga (Knock knee)

When the inward rotation of lower limb is increased and it occurs mainly in the area of the tights, the knees face each other during gait and the knees — projected to the frontal plane — are in definite valgus. The axle of heel often follows the line of the lower leg, and may be of increased valgus position as well.

In such cases, the AV construction axles can be of physiologic position (knees, ankles are in contact without loading), therefore, it is a functional valgus.
In lateral view, in standing position the centre line of gravity also intersects the horizontal axle of motion of knee joint passing through the femur condyles in transversal direction. In this position, the stability and the stationary position of the joint is ensured by the simultaneous contraction of agonist and antagonist muscles.
The patella is part of the frontal joint capsule being embedded into the tendon of the extensor muscle. It articulates with the femur in the patella-femoral joint.

In mechanical respect, the patella acts as a pulley mediating the extensor force of thigh to the tibia, i.e. hypomochlion.

As it increases the distance between the extension apparatus and the flexion-extension axle of the knee, it increases the tensioning force by 50% during the extension motions.
The 8th gestation week, the form of femur condyles shows the characteristic that is typical to adults and the condensation corresponding to the patella appears in the quadriceps.
In respect of radiology, the patella is "invisible" up to the age of 4-5, the ossification center appears between 5 and 11. The form typical to adults becomes visible only after the age of 11.
The geometry of cartilage surface of joint does not correspond to the osseous surface underneath.

Increase in knee joint flexion results in the increase of contact surface of patella, but at the same time, its form is also altered.

In case of normal function the lateral dimension of contact area of the patellar surface is larger: 1.6 to 1.0.
The patella is located in the crossing point of the system consisting of the joint capsule, retinaculum, soft part formed by ligament-muscle-tendon centrally.

In both transversal and longitudinal directions, its position is equally ensured by means of
- active
- passive stabilizing factors.
Figure 1.15. The superficial portion of the extensor apparatus.
For keeping the patella in place, the equilibrium of medial- and lateral stabilizing forces is required.

During the flexion of knee, the static lateral stabilizers cause the patella to be tilted and slide laterally, thereby causing subluxation or lateral pressure syndrome.
**Q angle** - angle formed by the direction of the quadriceps muscle and the ligament proprium patellae. Its normal value lies between 5 and 20 degree.
The development of the Q angle is in connection with the anteversion of femoral neck, as well as with the eversion position of the hindfoot, but there is no direct relationship between the Q-angle and the patellofemoral joint complaint!
Factors determining the pressure on the joint surface of patella:

- resulting force on the patellofemoral joint
- size of the joint surface
- size of the contact surface
While the patella preserves its position and distance from the femur, the extensor force of quadriceps and the force raising in the lig. patellae are equal and of opposite direction. The vector sum of these forces is the pressure force acting perpendicularly to the joint surface of the patellofemoral joint. This force increases when bending the knee.
Clinical symptoms:
- Pain, depending on position or more frequently on activity
- Crepitatio – even if any, not necessarily causes complaint!
- „giving way” – can also be caused by injury of meniscus, however, it is induced by torsional and rotational mechanisms. When climbing the stairs it appears of patellofemoral origin. It can be caused also simply by the weakness of quadriceps.
- Blocking – rather stuck feeling. It is typical to patellofemoral alteration when it is transient.
- Swelling (fluid in the joint?) - mostly intermittent or transient.
Clinical examination:

- Lateral-rotation of patella
- Medio – lateral sliding test
- Superior-inferior sliding test - crepitatio patellae
„My knee is out!”

Habitual patella dislocation?
„My knee is out!” without detectable dislocation in the knee joint it is not necessarily the sign of instability; instead, it often indicates the weakness of quadriceps. Its characteristics: age, sex, postural habit, body weight, acute subjective complaints, negative X-ray, ultrasonic test and minor clinical finding.

The pain in the knee is usually connected to activity.
Acute injury can be:

- direct trauma – cartilage lesions, contusion, distorsion
- indirect trauma („bagatelle trauma“) - osteochondral defects can occur under the effect of sharing forces on the medial part of the patella or at the lateral femoral condyle. (OCD)
Lateralization patellae ↔ lateral pressure syndrome

In case of lateralization of the patella, there is the possibility of “directing the patella to a correct way”, while in case of lateral pressure syndrome, the lateral retinaculum is tight to an extent that the patella is unable to move back to the anatomical position.
Types of Patella subluxation / translation /

1. **Minor recurrent lateral** subluxation – the patella slips out of its path without sensibly returning to its place. It is often symptom free.

2. **Major recurrent lateral** subluxation – the patella nearly leaves the lateral femur condyle, and then springs back to its place suddenly and audibly. Usually, it occurs at the beginning of flexion, the phenomenon is repeated irregularly.
3. **Persistent lateral patella displacement** – the patella remains in the lateral displacement position during flexion. At the end of flexion it shows inclination to return to its central position.
Types of patella dislocation

1. **Acute patellar dislocation (Luxation patellae):** indicates that the patella has been completely displaced from the femoral trochlea, and cannot reposed spontaneously. It is generally associated with a fall, and the patient is unable to arise alone. It must be treated carefully in the hope of avoiding recurrent dislocation.

2. **Permanent patella dislocation (acquired form):** – in case of 90-degree flexion of the knee, the patella spontaneously leaves its place in any case and slips next to the lateral condyle. On extension, it returns to its place. It occurs most frequently in the age 5 to 7.
3. **Recurrent patellar dislocation**: is frequent dislocation, even during benign activities such as walking, descending stairs, dancing, etc. Between dislocations, the knee is unstable and uncomfortable.

Habitual patellar dislocation = recurrent patellar dislocation
MALALIGNMENT PATTERNS

45 PATIENTS

Type 1 - Sublux without tilt
18 Patients, 21 Knees

Type 2 - Sublux with tilt
14 Patients, 19 Knees

Type 3 - Tilt without sublux
19 Patients, 25 Knees
Patella chondropathia

Inflammation type alteration occurring in patella cartilage of young people, causing pain from mild to mean severity and rigidity, that does not affect the load bearing surfaces.
Pain
- Getting sprained suddenly and acute pain

Instability
- Sudden tilt of patella

Instability can cause feeling of:
- Stuck, Adhered Joint surfaces
**Jumper’s knee** = patellar tendinitis – pressure sensitivity at the apex of the patella

**Hoffitis** – it is often a direct trauma – is developed as a result of kneeling.

**Pes anserinus bursitis** – Place of adhesion of ”slim-tailor-tendineus” muscles. (Gracilis, Sartorius and semitendinosus) Fluctuating soft tissues can be touched. Diff.dg.!
Morbus Schlatter-Osgood

Osteochondrosis of the tibia tuberositas. It is very frequent. The clinical symptoms are graded: from the mild swelling to the warm, red, shining, expansive painful inflammation. (5 signs of the inflammation) The complaint may be variable and can return for years. The diagnose is clear even without X-ray test. The treatment is palliative to reduce the pain. The apophysis heals with ossification. In case of malsanatio, mobile fragment can remain.
Baker cyst?  →  Ganglion!

The popliteal ganglion in childhood is developed mostly by sudden start, without causing any complaint. Usually it is along the medial or lateral origin of the hamstrings. Normally, it disappears spontaneously.
Haemarthros, OCD

Hemarthros can be developed even without OCD, however, the OCD is always accompanied by haemarthros.
The diagnostic of **haemarthros** is simple: suddenly developed liquid accumulation in the knee joint – usually under the effect of some sort of trauma. The liquid gained by puncture might be:

- **sanguis** (homogeneous blood)
- blood with fat drops
- bloody painted synovial liquid

Without trauma → hemophilia
If the X-ray shows no fracture, but there are fat drops in the sample aspirated, the possibility of OCD comes up in spite of negative radiology; in fact, small osseous bits invisible by X-ray test can also be associated with the bulky cartilage layer. The dissected bit usually breaks away from the medial edge of patella or from the lateral condyle of femur. Arthroscopy is necessary in the treatment.
Nonoperative treatment

- The patellar malposition
- Degree and location of chondrosis
- Retinacular soft tissue causes of pain
- Compensation-related problems
  must be defined.
Physiotherapy, rehabilitation:

- Kinetic chain mobilization
- Alignment and proprioception
- Stretching the kinetic chain
- Patellofemoral taping
- Strengthening
- Braces
- Activity modification