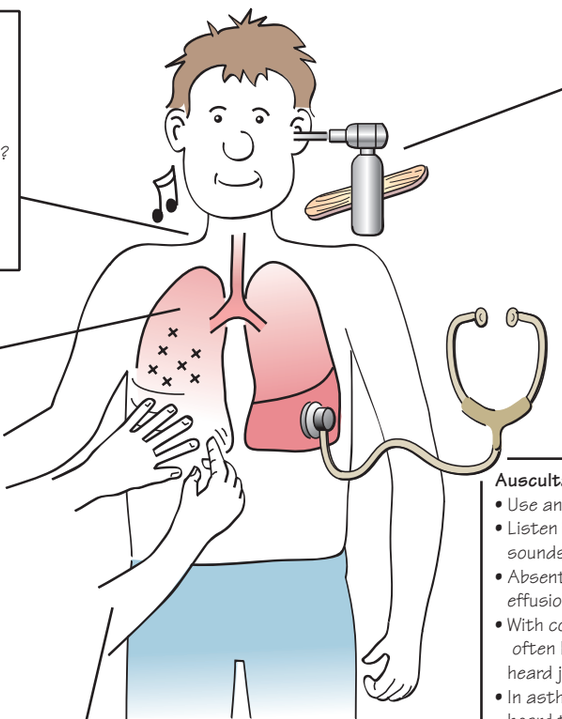
2 Systems examination

Respiratory system



Observation
- Is there respiratory distress?
  - -nasal flaring, recession
  - -use of accessory muscles
- Count the respiratory rate
- Is there wheeze, stridor or grunting?
- Is the child restless or drowsy?
- Is there cyanosis or pallor?
- Is there finger clubbing?
  - - cystic fibrosis, bronchiectasis

Ear, nose and throat
- Examine eardrums using an auroscope
  - -grey and shiny: normal
  - -red and bulging: suggests otitis media
  - -dull and retracted: chronic secretory otitis media (glue-ear)
- Examine nostrils for inflammation, obstruction and polyps
- Examine pharynx using tongue depressor (leave this until last!)
  - -Are the tonsils acutely inflamed (red +/- pustules or ulcers) or chronically hypertrophied (enlarged but not red)
- Feel for cervical lymphadenopathy

Chest wall palpation
- Assess expansion
- Check trachea is central
- Feel apex beat
- Is there chest deformity?

-Harrison's sulcus: asthma
-barrel chest: air-trapping
-pectus excavatum: usually isolated abnormality, can be associated with mitral valve prolapse or Marfan's syndrome
-pectus carinatum (pigeon chest): idiopathic or associated with severe asthma
- May 'feel' crackles

Auscultation
- Use an appropriately sized stethoscope!
- Listen in all areas for air entry, breath sounds and added sounds
- Absent breath sounds in one area suggests pleural effusion, pneumothorax or dense consolidation
- With consolidation (e.g. pneumonia) there is often bronchial breathing with crackles heard just above the area of consolidation
- In asthma and bronchiolitis expiratory wheeze is heard throughout the lung fields
- In young children upper airway sounds are often transmitted over the whole chest. Asking the child to cough may clear them

Percussion note

Resonant	Normal
Hyper-resonant	Pneumothorax or air-trapping
Dull	Consolidation (or normal liver in right lower zone)
Stony dull	Pleural effusions

Age	Respiratory rate at rest (breaths/min)
<1	30–40
1–2	25–35
2–5	25–30
5–12	20–25
>12	15–20

KEY QUESTIONS FROM THE HISTORY

Cough:
- Is there a history of cough?
- When is the cough worse? Nocturnal cough or a cough that occurs in the early morning may suggest asthma.
- Is the cough dry (viral), loose (productive), barking (croup) or paradoxical (whooping cough)?
- Has the child coughed up (or vomited) any sputum? Young children rarely expectorate sputum, but if present it is a sign of lower respiratory tract infection.
- Has there been a fever, which would suggest infection?

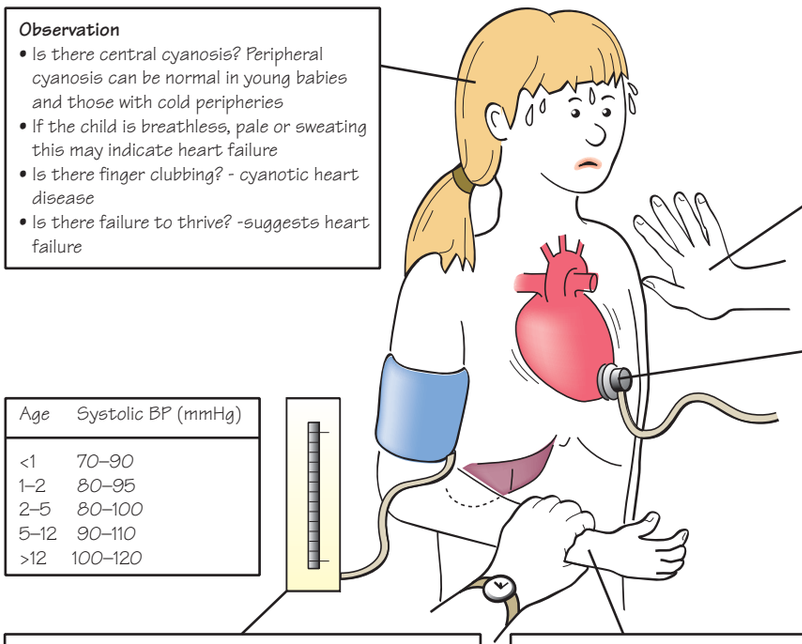
Wheeze:
- Is the child short of breath or wheezy?
- Are the symptoms related to exercise, cold air or any other triggers?
- How limiting is the respiratory problem—how far can the child run, how much school has been missed because of the illness?

Cough, wheeze or stridor in a young child:
- Was there a sudden or gradual onset? Was there a preceding coryzal illness (croup)?
- Is there any possibility the child may have inhaled a foreign body? Has there been an episode of choking?

Ear, nose and throat:
- Has the child been pulling at his ears (suggesting an ear infection)?
- Is there difficulty in swallowing (tonsillitis or epiglottitis)?
- Has the child had smelly breath? Halitosis may sometimes reflect tonsillitis.

Family history:
- Has there been a family history of respiratory problems (e.g. asthma, cystic fibrosis)?
- Asthma, eczema or hay fever in close relations may indicate an atopic cause.
- Has the child travelled abroad or been in contact with relatives who might have TB?

Cardiovascular system



Observation
- Is there central cyanosis? Peripheral cyanosis can be normal in young babies and those with cold peripheries
- If the child is breathless, pale or sweating this may indicate heart failure
- Is there finger clubbing? - cyanotic heart disease
- Is there failure to thrive? -suggests heart failure

Palpation
- Feel apex beat (position and character), reflects left ventricular function
- Feel for right ventricular heave over sternum (pulmonary hypertension)
- Feel for thrills (palpable murmurs)
- Hepatomegaly suggests heart failure. Peripheral oedema and raised JVP are rarely seen in children

Auscultation
- On the basis of the child's age, pulse, colour and signs of failure try to think what heart lesion may be likely, then confirm this by auscultation
- Listen for murmurs over the valve areas and the back (see p. 56). Diastolic murmurs are always pathological
- Listen to the heart sounds: are they normal, increased (pulmonary hypertension), fixed and split (ASD) or are there added sounds (gallop rhythm in heart failure or ejection click in aortic stenosis)?

1 2 1

Systolic murmur

Age	Systolic BP (mmHg)
<1	70–90
1–2	80–95
2–5	80–100
5–12	90–110
>12	100–120

Circulation
- Measure blood pressure with age-appropriate cuff, which should cover 2/3 of the upper arm
- Check capillary refill time (CRT) by pressing on the skin for 5 seconds—the time taken for the blanching to fade is the CRT. Normal is ≤2 s. A prolonged CRT >2 s may be a sign of shock. If the child is in a cold room peripheral CRT may be delayed, so always check centrally (e.g. over the sternum)

Pulse
- Rate: fast, slow or normal?

Age (years)	Normal pulse (beats/min)
<1	110–160
2–5	95–140
5–12	80–120
>12	60–100

- Rhythm: regular or irregular? Occasional ventricular ectopic beats are normal in children
- Volume: full or thready (shock)
- Character: collapsing pulse is most commonly due to patent arterial duct. Slow rising pulse suggests left ventricular outflow tract obstruction
- Always check femoral pulses in infants—coarctation of the aorta leads to reduced or delayed femoral pulses

KEY QUESTIONS FROM THE HISTORY

Exercise:
- Has the child been breathless or tired (may suggest cardiac failure)?
- Is the child limited by exercise—is this due to shortness of breath, palpitations or (rarely) chest pain?
- Do they play competitive sports (very rarely may need to be limited with some obstructive cardiac defects)?

Colour change:
- Has the child ever been cyanosed? Was this central (lips and tongue) or peripheral (hands and feet)? Some cyanosed children look grey rather than blue.
- Has the child been pale and sweaty (may suggest cardiac failure or an arrhythmia)?

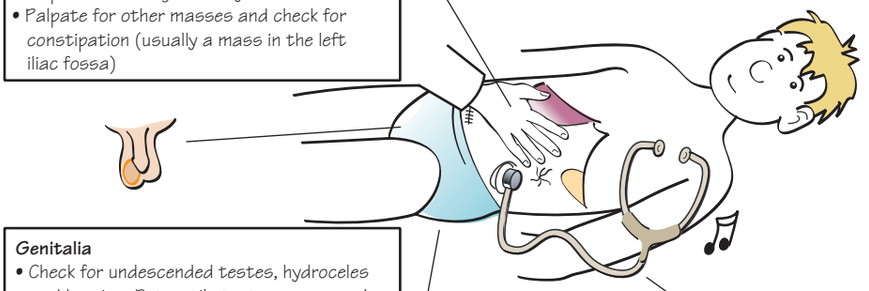
Growth:
- Ask about the pattern of feeding in babies, as breathlessness may slow down feeding.
- Review the child's growth—is there evidence of failure to thrive?

Syncope:
- Has there been any unexplained collapse, such as fainting?
- Has the child ever complained of palpitations or of their heart racing? Ask the parents to 'tap out' the rate.

Family history:
- Is there a family history of congenital heart disease?
- Have there been any sudden deaths in early adulthood (congenital cardiomyopathy)?
- Is there an associated syndrome that increases the chance of a cardiac defect (e.g. Down syndrome, or Turner's, Marfan's or Noonan's syndrome)?

Murmurs:
- Has anyone ever noticed a heart murmur in the past? (Physiological flow murmurs may only be present at times of illness or after exercise.)
- If the child has a heart defect, have they been taking prophylactic antibiotics for dental or other invasive treatment? (Especially important for valve disorders and ventricular septal defects.)

Abdominal system and nutritional status



Palpation
- Use warm hands and ask whether the abdomen is tender before you begin
- Is there distension, ascites or tenderness?
- Palpate the liver 1–2 cm is normal in infants. Is it smooth and soft or hard and craggy?
- Feel for spleen, using bimanual palpation. Turning the child onto the right side may help
- Palpate for enlarged kidneys
- Palpate for other masses and check for constipation (usually a mass in the left iliac fossa)

Observation
- Make sure the child is relaxed—small children can be examined on a parent's lap; older children should lie on a couch
- **Jaundice**: look at the sclera and observe the urine and stool colour
- Check conjunctivae for anaemia
- **Oedema**: check over tibia and sacrum. Periorbital oedema in the mornings may be the first thing noticed by parents
- Skin: look for spider naevi—suggests liver disease
- **Wasted buttocks**: suggests weight loss and is characteristic of coeliac disease
- Measure the mid upper arm circumference (MUAC). Between 6 months and 5 years the MUAC is usually ≥14 cm. MUAC <12.5 cm represents moderate malnutrition

Genitalia
- Check for undescended testes, hydroceles and hernias. Retractile testes are normal
- In girls examine the external genitalia if there are urinary symptoms

Observation
- Percuss for ascites (shifting dullness) and to check for gaseous distension

Rectal examination
- This is very rarely indicated, but examine the anus for fissures or trauma

Auscultation
- Listen for normal bowel sounds. 'Tinkling' suggests obstruction

KEY QUESTIONS FROM THE HISTORY

Nutrition:
- Review the child's diet. Ask in detail what the child eats: '*Take me through everything you ate yesterday*'.
- Is the quantity of calories sufficient and is the diet well balanced and appropriate for the child's age?
- In babies check that the type and amount of milk being offered is appropriate—excessive volumes may lead to vomiting. (Remember 1 fl. oz = 28 ml.)
- Ask about weaning, if appropriate.
- Does the child have a good appetite?
- Ask about the pattern of weight gain. The parent-held record (the 'red book') can provide invaluable information about previous height and weight measurements.

Vomiting:
- Has there been any vomiting?
- Is there blood in the vomit? This might suggest gastritis, oesophagitis or varices.
- In babies ask about posseting (small vomits of milk) and regurgitation of milk into the mouth, which may suggest gastro-oesophageal reflux.

Bowel habit:
- Has there been any diarrhoea? Always assess what the parents mean by diarrhoea—frequent stools or loose stools or both?
- Has the child been constipated? Straining, pain or bleeding on defaecation, poor appetite and a bloated feeling may suggest this is a problem.
- What colour are the stools? Pale stools and dark urine suggest obstructive jaundice.
- Are the stools greasy and difficult to flush away (suggests fat malabsorption)?

Urinary symptoms:
- Does the child have frequency, dysuria, haematuria or enuresis?

Pain:
- Does the child have any abdominal pain? Ask about the site and nature of the pain. Is it colicky (spasmodic) or continuous?
- Was the onset of pain gradual or sudden?
- Is there a family history of bowel problems (e.g. coeliac disease, inflammatory bowel disease, constipation, pyloric stenosis)?
- Is there a family history of migraine (may be associated with abdominal pain)?

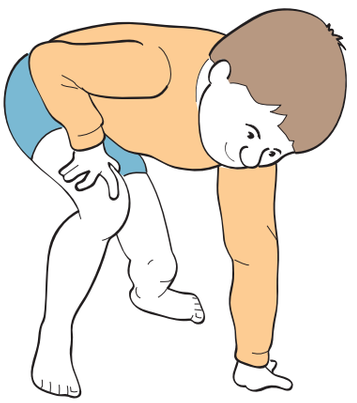
Neurological assessment

Observation
- Abnormal movements: choreoathetoid 'writhing' movements, jerks in myoclonic epilepsy and infantile spasms
- Gait—this can provide important clues:
  - -stiffness: suggests UMN lesion
  - -waddling: Duchenne muscular dystrophy (DMD) or congenital dislocation of hips
  - -scissoring of legs: spastic diplegia
  - -weakness on standing, e.g. boys with DMD stand up by 'walking up' their legs with their hands. This is the Gower sign (see picture)
  - -broad based gait: ataxia
- Muscle bulk/wasting
- Posture: look for evidence of contractures

Tone
- Hypotonia suggests LMN lesion
- Spasticity suggests UMN lesion and is seen in cerebral palsy, especially in thigh adductors and calf muscles (may cause toe walking)

Power
- Describe in upper and lower limbs
- Describe whether movement is possible against resistance or against gravity

Cranial nerves
- Examine as in adults
- Drooping mouth or expressionless face may be a sign of myopathy (e.g. myotonic dystrophy)



Coordination
- Finger–nose test and heel–shin test, and observe gait. Very important if considering CNS tumours as cerebellar signs are common

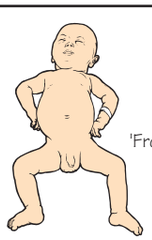
Reflexes
- Assess at knee, ankle, biceps, triceps and supinator tendons
- Clonus may be seen in UMN lesions
- Plantar reflex is upwards until 8 months of age, then downwards

Neurological examination in infants

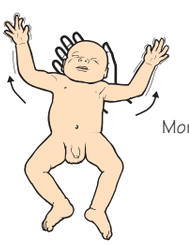
Young children cannot cooperate with a formal neurological examination so observation becomes more important: watch what the child is doing while you play with them
- How does the infant move spontaneously? Reduced movement suggests muscle weakness
- What position are they lying in? A severely hypotonic baby adopts a 'frog's leg' position (see below)
- Palpate anterior fontanelle to assess intracranial pressure
- Assess tone by posture and handling: a very floppy hypotonic baby tends to slip through your hands like a rag doll. Put your hand under the abdomen and lift the baby up in the ventral position: a hypotonic infant will droop over your hand. Pull the baby to sit by holding the baby's arms: observe the degree of head lag. Hypertonia is suggested by resistance to passive extension of the limbs and by scissoring (crossing-over) of the lower limbs when the infant is lifted up (see below)

Moro reflex	Symmetrical abduction and then adduction of the arms when the baby's head is dropped back quickly into your hand (see below). Usually disappears by 4 months
Palmar grasp	Stroking the palm causes hand to grasp. Usually disappears by 3 months
Asymmetrical tonic neck reflex	When the head is turned to one side the baby extends the arm on that side and flexes the contra lateral arm ('fencing posture', see below). Disappears by 6–7 months

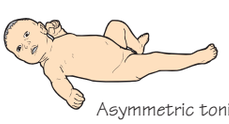
Scissoring of the lower limbs



'Frog's leg' position



Moro reflex



Asymmetric tonic neck reflex

KEY QUESTIONS FROM THE HISTORY

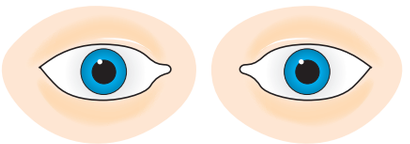
- Have there been any developmental concerns? Quickly review major milestones.
- Has there been any concern about hearing or vision? Have the parents noticed a squint?
- Did the child pass the universal newborn hearing screening test (oto-acoustic emissions)?
- Has the child ever had a convulsion or unexplained collapse?
- Is there a relevant family history (ask specifically about blindness, deafness, learning difficulties and genetic disorders such as muscular dystrophy)? It is surprising how often this information is not mentioned by the family, unless directly asked.
- Has there been any change in school performance or personality?
- Has the child been clumsy or had a change in gait?
- Has there been any loss of skills? Developmental regression is an extremely worrying sign.
- Has there been any headache or vomiting (may suggest raised intracranial pressure)?
- Ask about function—how is the child limited by their condition, if at all?
- Briefly review the social situation—does the family receive any relevant benefits, e.g. disability living allowance? Are there mobility problems?

The visual system

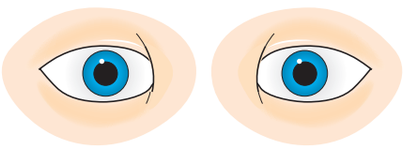
Observation of eyes
- Look at the iris, sclera and pupil
- Check pupils are equal and react to light, both directly and indirectly
- Look for red reflex to exclude cataract, especially in the newborn
- Look at reflection of light on the cornea—is it symmetrical or is one eye squinting? (see box opposite)
- Look at the inner epicanthic folds—if very prominent they may cause a pseudosquint

Visual acuity
- Does the child fix and follow an object through 180 degrees?
- Can they see small objects (e.g. hundreds and thousands, small rolling Stycar balls)
- Older children can perform a modified Snellen chart with objects

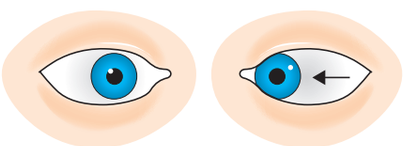
Ocular movements and visual fields
- Test full range of movements, looking for paralytic muscle or nerve lesions
- Look for and describe any nystagmus
- Check visual fields by using a 'wiggling' finger



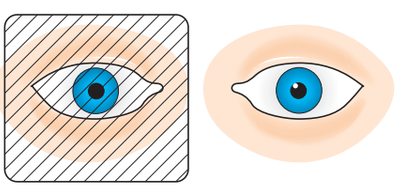
Normal symmetrical light reflex



Pseudosquint due to prominent inner epicanthic folds



Left convergent squint– note asymmetrical light reflex



When the good eye is covered the squinting eye straightens (fixates)

Assessment of a squint
- Any squint in an infant beyond the age of 6 weeks needs referral to an ophthalmologist. A squinting eye that is left untreated may cause amblyopia (cortical blindness) on that side
- Some 'latent' squints are present only when the child is tired; the history is important
- Check the corneal light reflex at different angles of gaze
- Check ocular movements—is there a fixed angle between the eyes or a paralytic squint, where the squint increases with eye movement?
- Check visual acuity
- Perform fundoscopy and red reflex
- Perform the **cover test** by asking the child to fix on an object. Cover the 'good' eye and watch the squinting eye flick to fix on the object. Latent squints may also become apparent when that eye is covered
- Divergent squints are usually more pathological

Fundoscopy
- An essential but difficult skill—practise on every child you see!
- Look at the anterior chamber of the eye. Cloudiness of the cornea suggests a cataract
- Examine the red reflex by looking through the ophthalmoscope held at a distance from the patient's eye. If the red reflex is absent this suggests cataract. A white reflex is suggestive of retinoblastoma
- Complete the examination by carefully examining the optic disc and retina

KEY QUESTIONS FROM THE HISTORY

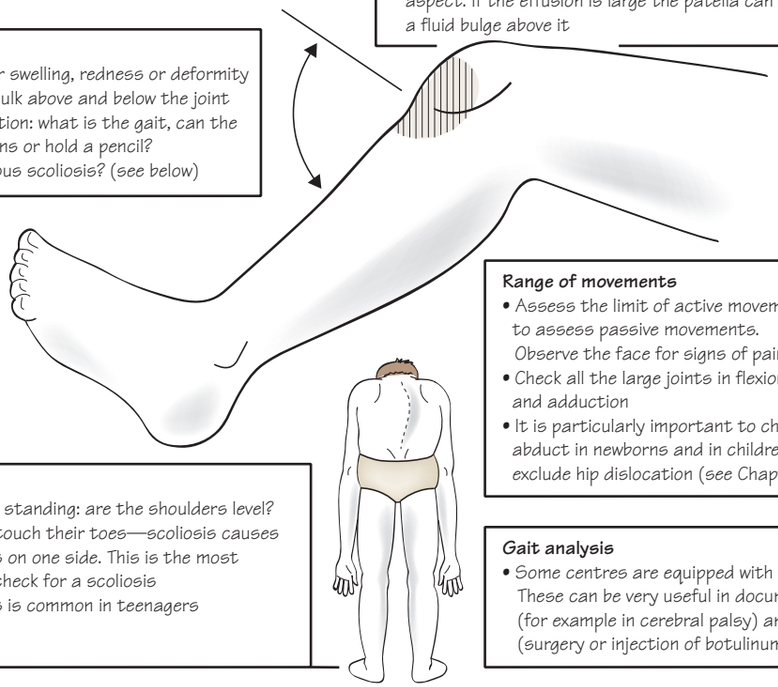
- Have the parents been concerned about the child's vision?
- Has anyone ever noticed a squint? If so, is it there all the time (manifest) or does it only appear when the child is tired (latent)?
- Is the child able to see clearly (e.g. the board at school)?
- Is there any relevant family history (e.g. retinitis pigmentosa, congenital cataracts)?
- Has the child been complaining of headaches, which may suggest poor visual acuity?
- Has the child seen an optician recently?
- Are there any risk factors for visual problems, such as extreme prematurity, diabetes mellitus or other neurological concerns?

Musculoskeletal system

Individual joint problems are discussed in Chapters 41 and 61

Palpation
- Feel the temperature of the skin over the joint, and feel for joint tenderness
- Feel for an effusion: in the knee milk fluid down and feel a bulge in the medial aspect. If the effusion is large the patella can be rocked in and out, causing a fluid bulge above it

Observation
- Observe joints for swelling, redness or deformity
- Observe muscle bulk above and below the joint
- Observe the function: what is the gait, can the child do up buttons or hold a pencil?
- Is there any obvious scoliosis? (see below)



Range of movements
- Assess the limit of active movements, then move the child's limb to assess passive movements.
  Observe the face for signs of pain, and stop before this occurs
- Check all the large joints in flexion, extension, rotation, abduction and adduction
- It is particularly important to check that the hip joints fully abduct in newborns and in children with cerebral palsy in order to exclude hip dislocation (see Chapter 14)

Scoliosis
- Observe the child standing: are the shoulders level?
- Ask the child to touch their toes—scoliosis causes bulging of the ribs on one side. This is the most sensitive way to check for a scoliosis
- Postural scoliosis is common in teenagers

Gait analysis
- Some centres are equipped with video gait analysis laboratories. These can be very useful in documenting complex gait abnormality (for example in cerebral palsy) and response to treatment (surgery or injection of botulinum toxin)

KEY QUESTIONS FROM THE HISTORY

- Has the child had any joint pain or swelling?
- Is the child able to walk and exercise normally?
- Is there a limp? Is there a possibility of trauma?
- Have the parents noticed any change in gait—waddling gait suggests muscular dystrophy or congenital dislocation of the hip. Limping gait may be due to pain or a hemiplegia. Tip-toe walking can be behavioural but may also be a sign of calf muscle spasticity.
- Are there signs of clumsiness? Many children go through a clumsy phase during the adolescent growth spurt.
- Has there been any unexplained fever (may suggest autoimmune disorders or septic arthritis)?
- What is the level of function like—can the child manage fiddly tasks such as doing up buttons?
- Have the parents noticed any rashes (may suggest rheumatoid disease (see p. 129) or Henoch–Schönlein purpura (see p. 101))?

KEY POINTS

- Examining young children takes skill and patience.
- Gain the child's confidence first.
- Take into account the child's age and developmental level when approaching the examination.
- Leave difficult or uncomfortable parts of the examination until the end.
- Always use a chaperone—this is usually the parent.
- Remember infection control—wash your hands before and after each examination and always use sterilized instruments.