CLINICAL MANIFESTATIONS OF LOW BACK AND SCIATIC PAIN
Value for Diagnosis

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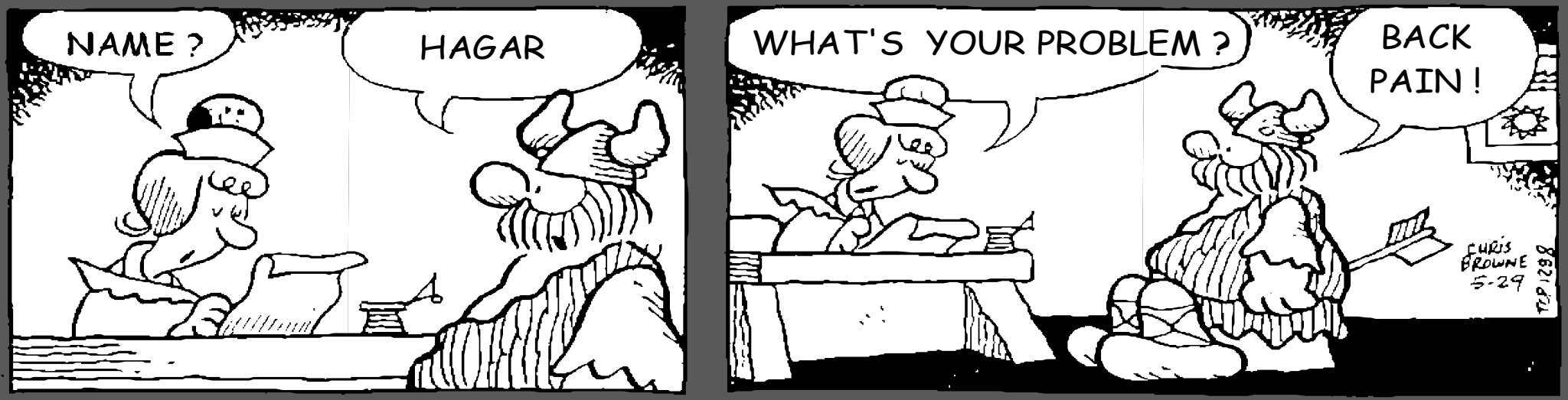


A rare cause of Low Back Pain ...

- Back strain syndromes
  - Iliolumbar ligament
  - Multifidus muscle
  - Interspinous ligament
  - Acute facet strain
  - Sacroiliac strain
  - Postural strain
  - Annulus tear (?)
  - Nonspecific strain
- Chronic post-traumatic strain
- Tension myalgia
  - General
  - Lumbar
- Pelvic floor myalgia
- Bursitis
  - Trochanteric
  - Ischial
  - Multifidus
  - Gluteal
  - Interspinous
- Compression fracture
  - Osteoporosis
  - Trauma
- Ankylosing spondylitis
- Other B-27 spondylitis variants
  - Reiter's syndrome
  - Psoriatic
  - Juvenile rheumatoid
  - Inflammatory bowel disease
- Paget's disease
- Infectious
  - Tuberculous spondylitis
  - Brucellar spondylitis
  - Osteomyelitis
  - Fungal
    - Coccidioidomycosis
    - Cryptococcosis
  - Parasitic
    - Echinococcosis
- Disk space infection
- Coccyx fracture/trauma
- Osteitis condensans ilii
- Sacroiliac instability
- Referred
  - Internal organ
    - Thoracic, abdominal
    - Retroperitoneal
    - Cardiac
    - Aortic (aneurysm)
    - Renal
    - Pancreatic
    - Gastric
    - Abscess, retroperitoneal
- Protruded/herniated disk
- Degenerative disk disease (DDD)
- Facet degenerative joint disease (Facet DJD)
- Segmental instability
- Spondylolisthesis
- Degenerative spondylolisthesis
- Diffuse idiopathic skeletal hyperostosis (DISH, Forestier's)
- Postoperative, chronic nonspecific
- Leg length difference (>2 cm)
- Psychogenic
  - Somatization
  - Learned pain behavior
- Malingering
- Spinal stenosis
  - Lateral recess stenosis
- Arachnoiditis
  - Primary
  - Secondary
  - Postoperative
  - Post-myelographic
- Congenital
  - Asymmetrical vertebrae
  - Asymmetrical facets
  - Other
- Scoliosis
  - Congenital and infantile
  - Juvenile idiopathic
  - Neuromuscular
  - Degenerative
- Scheuermann's juvenile kyphosis
- Charcot's arthropathy (neuropathic arthropathy)
- Metabolic
  - Gout
  - Chondrocalcinosis (pseudogout)
  - Hemochromatosis
  - Ochronosis
  - Osteomalacia
    - Primary (rickets)
    - Secondary (renal)
- Urologic
  - Urolithiasis
  - Infection
  - Obstruction
- Gynecologic
  - Endometriosis
  - Infection (PID)
  - Tumor
  - Ovarian
  - Mittelschmerz
  - Tubal
- Tumor
  - Lymphoma
  - Myeloma
  - Metastatic
    - Breast
    - Prostate
    - Lung
    - Thyroid
    - Kidney
  - Spinal, primary
    - Benign
      - Osteoid osteoma
    - Malignant
      - Sarcoma
      - Chordoma
      - Other
  - Calvé-Perthes disease, vertebra plana (aseptic necrosis)
  - Radiation necrosis
  - Neurofibromatosis (von Recklinghausen's disease)
  - Dysplasia

Is back pain a communicable disease ?

Survey	Type of BP	North	East Germany (E)	West Germany (W)	Difference prevalence (W – E)
1. 1991–92	BP[a] today	East: 2209[b]	27% (25.2–28.9)	39% (37.3–40.8)	12% (9.5–14.6)
	BP past 12 months	West: 3109	63% (60.6–64.7)	75% (73.4–76.5)	13% (9.5–14.5)
	BP ever		69% (66.5–70.4)	84% (82.7–85.3)	16% (12.7–17.3)
2. 1992–93	BP today	East: 2064	36% (33.6–37.8)	43% (41.3–45.4)	7% (4.7–10.6)
	BP past 12 months	West: 2213	73% (71.3–75.1)	74% (71.9–75.6)	1% (−2.1–3.2)
	BP ever		83% (81.4–84.7)	87% (85.1–88.0)	4% (1.3–5.6)
3. 1998–99	BP last 7 days	East: 1409	32% (29.2–34.1)	37% (36.1–38.7)	5% (3.8–9.3)
	BP past 12 months	West: 5539	53% (50.7–55.9)	61% (59.5–62.0)	8% (4.6–10.4)
4. 2003	BP yesterday	East: 1540	22% (20.5–24.7)	22% (21.3–23.2)	0% (−2.0–2.6)
	BP past 12 months	West: 6777	62% (59.3–64.3)	62% (60.6–62.9)	0% (−2.7–2.7)
	Chronic BP past 12 months		18% (15.8–19.7)	19%(17.9–19.8)	1% (−0.9–3.3)

Back pain and development level ?

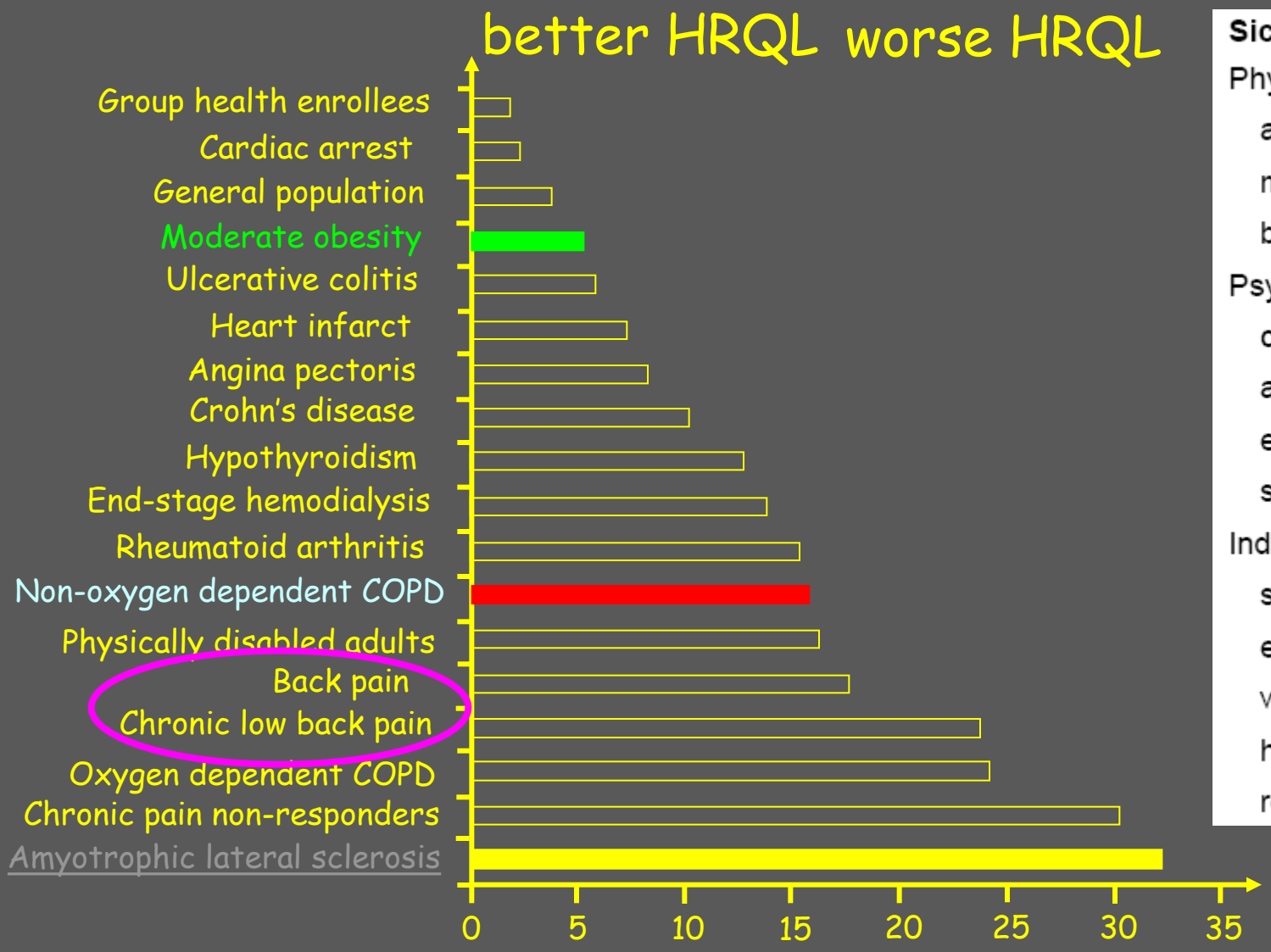
Point prevalence of low back pain

Country (GNP per capita)	Study (year)	Specific Population	Sex (age group, yr)	No. in Sample	Findings Related to Back Pain Prevalence
A. Rural general populations					
Nepal ($180)	Anderson[1] (1984)	Mountainous farming community	M and F (>15)	646	18% reported back or neck pain
India ($330)	Fahrni[20] (1975)	Jungle population	M and F (15–44)	450	Respondents reported no back pain
Nigeria ($340)	Dixon and Thompson[19] (1993)	Four farming villages in north-eastern Nigeria	M and F, M heads of households and F of child-bearing age	1960	16% reported back pain
China ($370)	Wigley et al[54] (1994)	Rural south China	M and F (>20)	5057	12% of men and 14% of women reported low back pain
Indonesia ($610)	Darmawan et al[17] (1992)	Two farming communities in Java	M and F (>14)	4683	15% reported low back pain
Philippines ($730)	Manahan et al[32] (1985)	Mountainous farming community	M and F (>15)	1675	7% reported low back pain
B. Urban general populations					
China ($370)	Wigley et al[54] (1994)	Bejing area of north China	M and F (>20)	4192	28% of men and 43% of women reported low back pain
Indonesia ($610)	Darmawan et al[17] (1992)	A large city in Java	M and F (>15)	1071	23% reported low back pain

GNP = gross national product.
Note: GNP per capita data are from the World Bank.[55]

Volinn E. (1997) The Epidemiology of Low Back Pain in the Rest of the World: A Review of Surveys in Low- and Middle-Income Countries. Spine. 22:1747-1754

Health Related Quality of Live



Sickness Impact Profile

Physical dimension
- ambulation
- mobility
- body care and movement

Psychosocial dimension
- communication
- alertness behaviour
- emotional behaviour
- social interaction

Independent categories
- sleep and rest
- eating
- work
- home management
- recreation and pastimes

Overall Sickness Impact Profile score (from 0 to 100)

Patrick DL, Deyo RA Med Care 1989;27:s217-s232

CLINICAL PRESENTATION

SYMPTOMS

SUBJECTIVE ?

CLINICAL PRESENTATION

SIGNS

OBJECTIVE ?

- ***An objective cause of nociception cannot be indentified in more than 80 % of patients complaining of low back troubles***

- ***The relation of low back troubles and findings of technical investigations (Xrays, CT, MRI …) is at best inconsistent and more often very poor***

SYMPTOMS OF A SYMPTOM !

LOW BACK PAIN IS A SYMPTOM AND NOT A PATHOLOGY

SYMPTOMS OF A SYMPTOM !

CLINICAL PRESENTATION OF A SYMPTOM MOST OFTEN DUE TO MULTIFACTORIAL FUNCTIONAL TROUBLES ?

SYMPTOMS

HISTORY

- ***General medical history***
  - Family history of spinal troubles
  - History of abdominal, urogenital, gynecologic diseases
  - History of trauma
  - Childhood history
  - Cancer, infection, immunosuppression, weight loss …
  - Medications, smoking habits
  - Vascular troubles
  - ...

SYMPTOMS

HISTORY

- ***Specific « Back troubles » oriented history***
  - Back pain
  - Stifness, weakness, hypoesthesia, paresthesia ...
  - Other neurologic troubles
  - Bowel or bladder dysfunction
  - Gait troubles, claudication
  - …

SYMPTOMS

HISTORY

- ***Psycho-social history***
  - Psychiatric troubles
  - Medications: anxiolytics, hypnotics, antidepressants...
  - Alcohol or drug abuse
  - Family problems
  - ...

SYMPTOMS

HISTORY

- ***Socio-economic history***
  - Occupationnal history, typical job tasks
  - Worker ’s comp and disability issues
  - Other litigations related to back troubles
  - Educational level
  - Sport and hobby practice
  - ...

PAIN

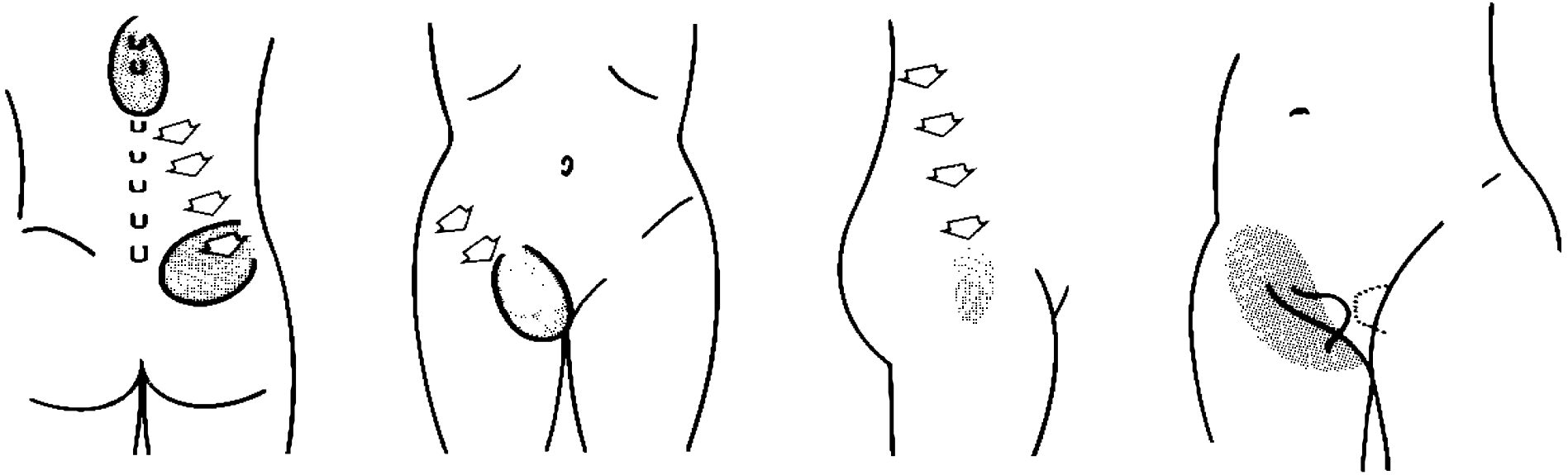
- Circumstances of onset
- Location, irradiation
- Quality
- Duration
- Periodicity

PAIN

- Coughing, sneezing, sitting increases : HNP
- Walking increasing, sitting decreasing: stenosis

PAIN

- ***Classification by location/radiation***
  - Local : lower lumbal or lumboscral area
  - Referred : located at the area that shares a common embryologic origin with the region involved (sclerotomal pain)
  - Radicular : located along the dermatomal distribution of a spinal nerve root (dermatomal pain)



Some reffered pain patterns

!! Pseudo Gyneco, pseudo Uro, pseudo Abdo…etc !!

Dermatomal distribution by each nerve root level

PAIN

- Pain radiating below knee : nerve root compromise
- Pain radiating to inguinal or buttock region, thighs : LBP
- Pain remaining in lumbo-sacral region : LBP

!! May be misleading !!

PAIN

- ***Classification by onset/duration***
  - Acute: immediate onset, duration 0 - 3 mo
  - Subacute : slow onset, duration 0 - 3 mo
  - Chronic : duration more than 3 mo
  - Recuring : pain recurring after a symptom free period

PAIN

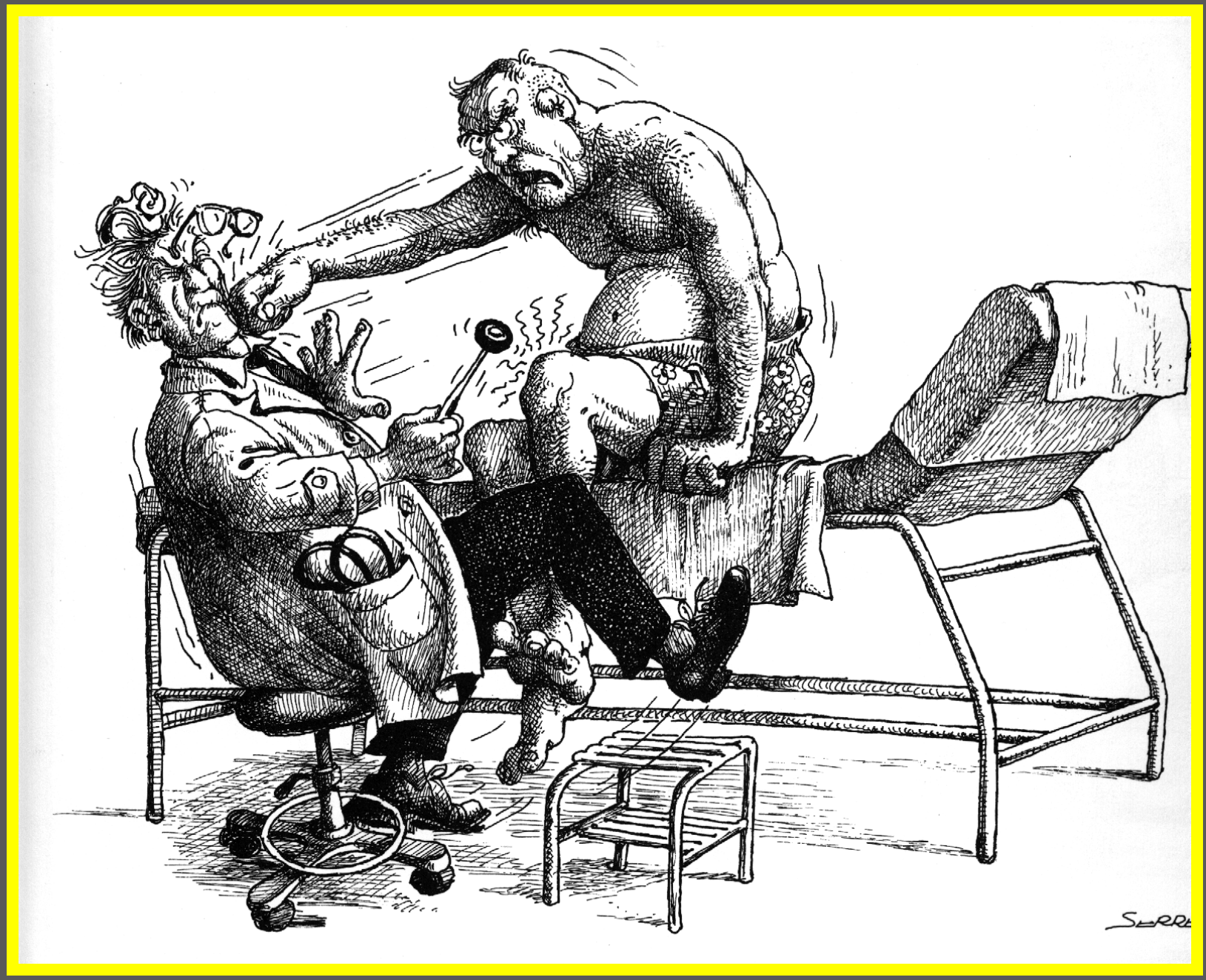
- « Assessment »
  - Visual Analog Scale (VAS)
  - Pain drawings

Information of little interest on initial clinical assessment, limited use in follow-up of progress

CLINICAL EXAMINATION : SIGNS

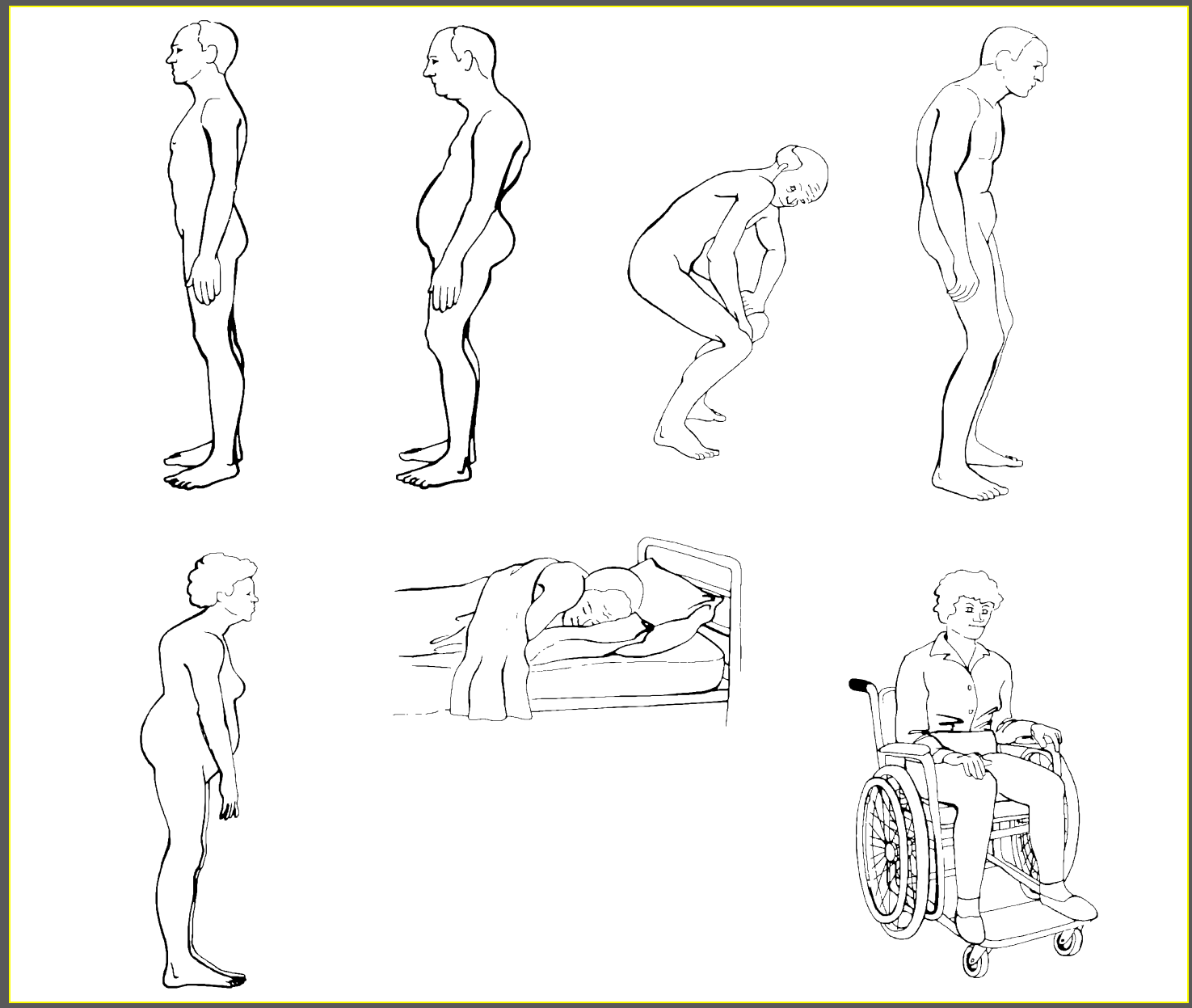
- ***Mostly subjective*** : patient response or interpretation required for nearly all parts (except reflexes and circumferencial measurements)

- ***Low reliability*** : high intra and interobserver error even in ROM or SLR tests (Nelson et al 1979, Waddell 1982)



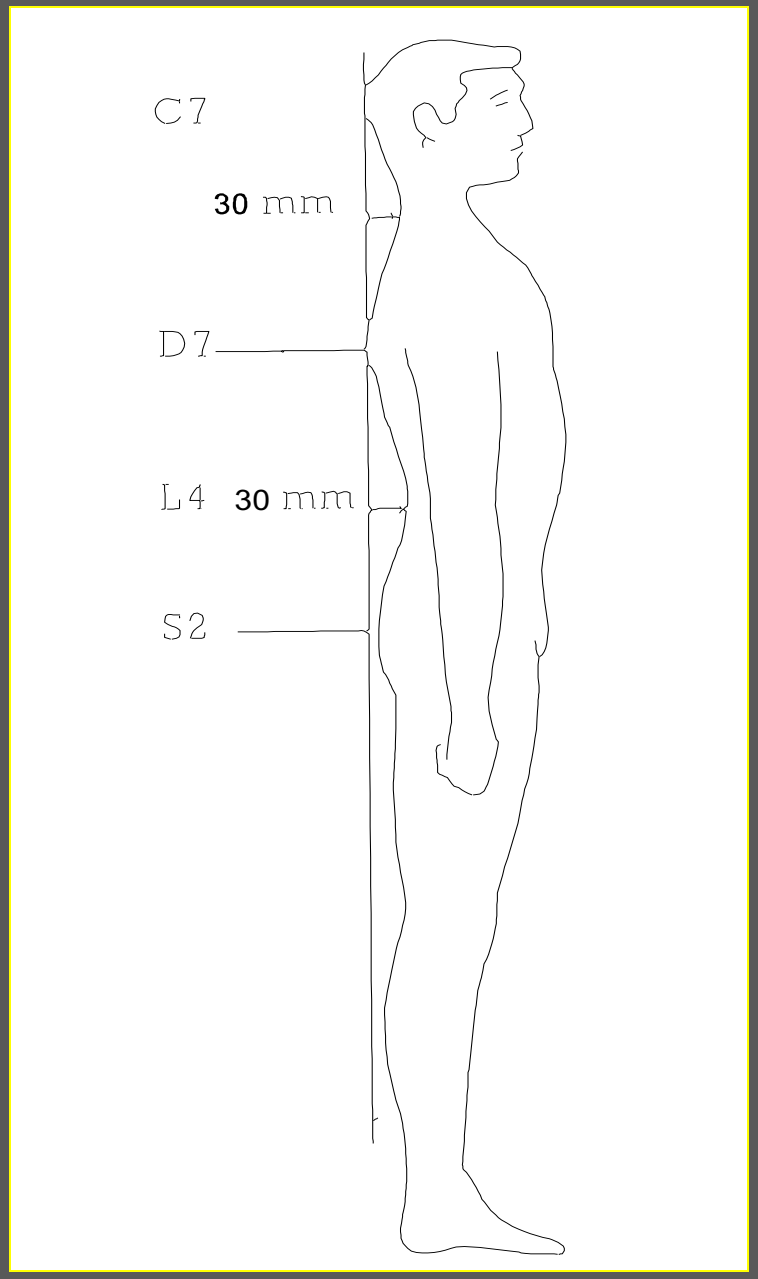
« OBJECTIVE » PHYSICAL SIGNS

- ***STATIC SIGNS***
  - Difformities, Curvatures modifications (cause or result ?)
  - Trunk list (Disc or ?)
  - Asymetrical circumferencial measurements
  - Palpation, percussion, pressure: spine, paraspinal muscles, sacro-iliac joints
  - « Doorbell sign »: pressure on spinous process reproduces sciatic pain
  - Leg length assymetry
  - ...

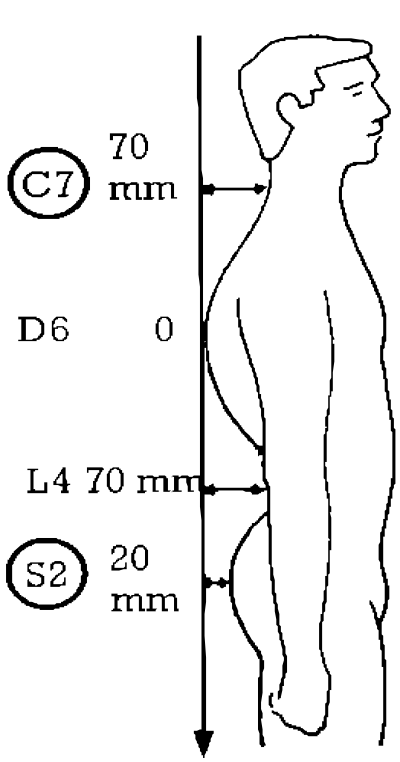


Back pain syndromes !!!

Normal Curves

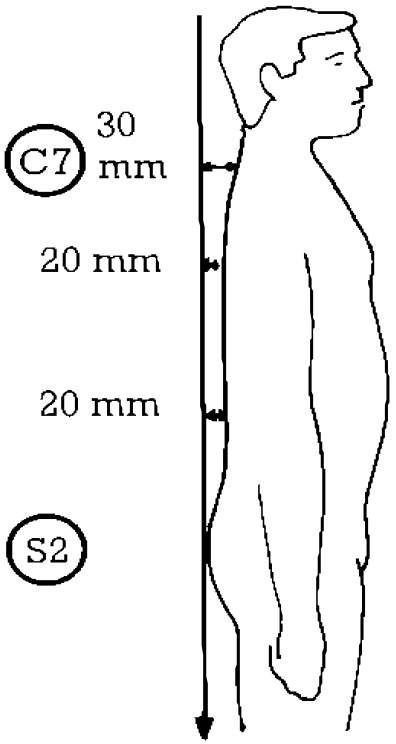


Spinal curvatures



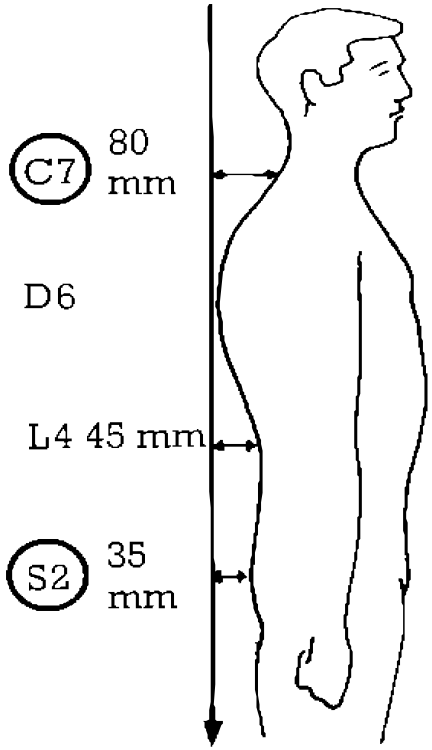
KYPHOLORDOSIS

Increased Curves

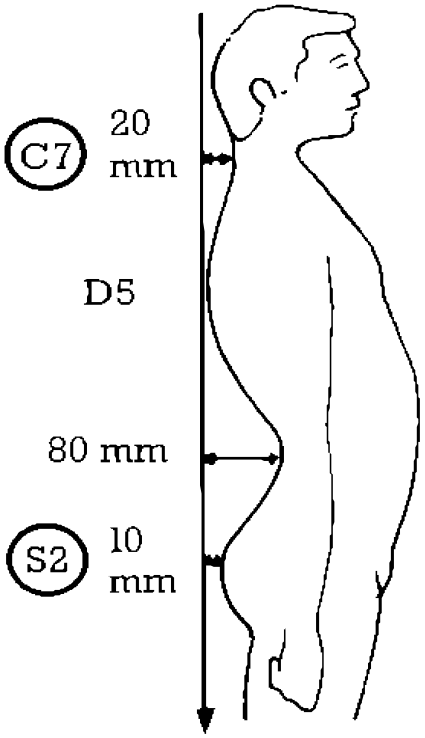


FLAT BACK

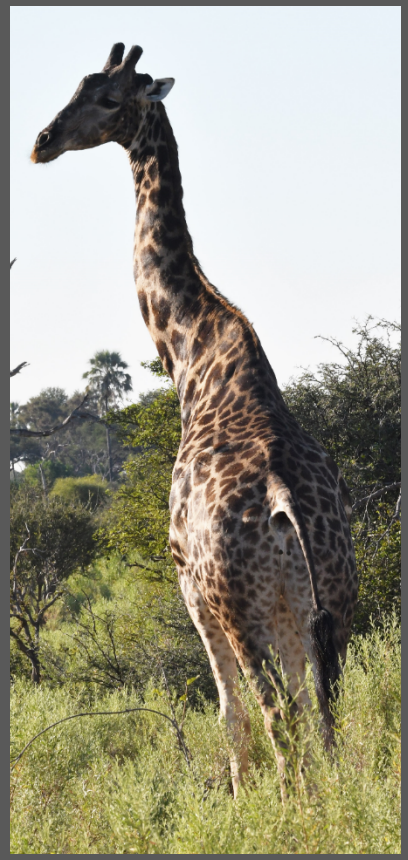
Decreased Curves

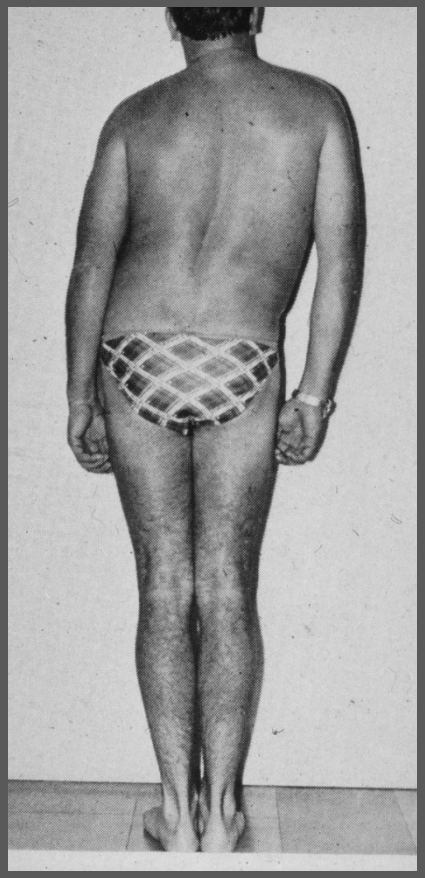


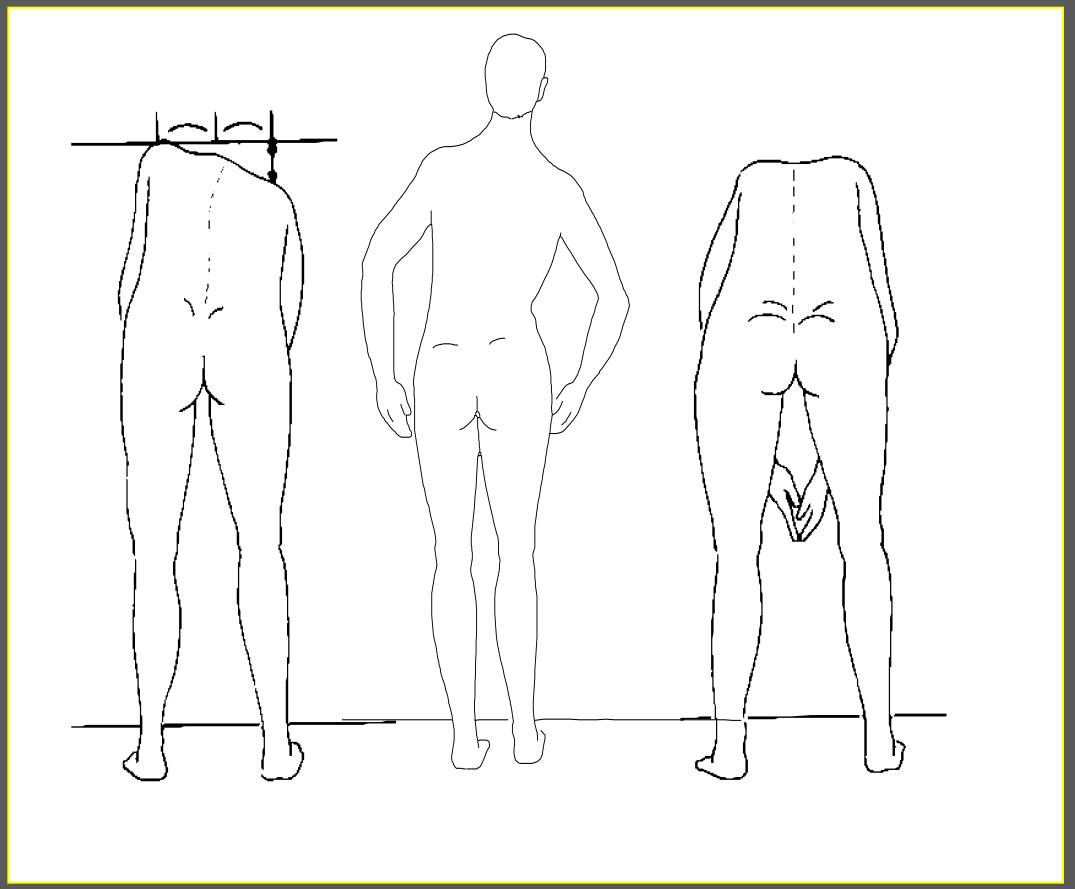
KYPHOSIS



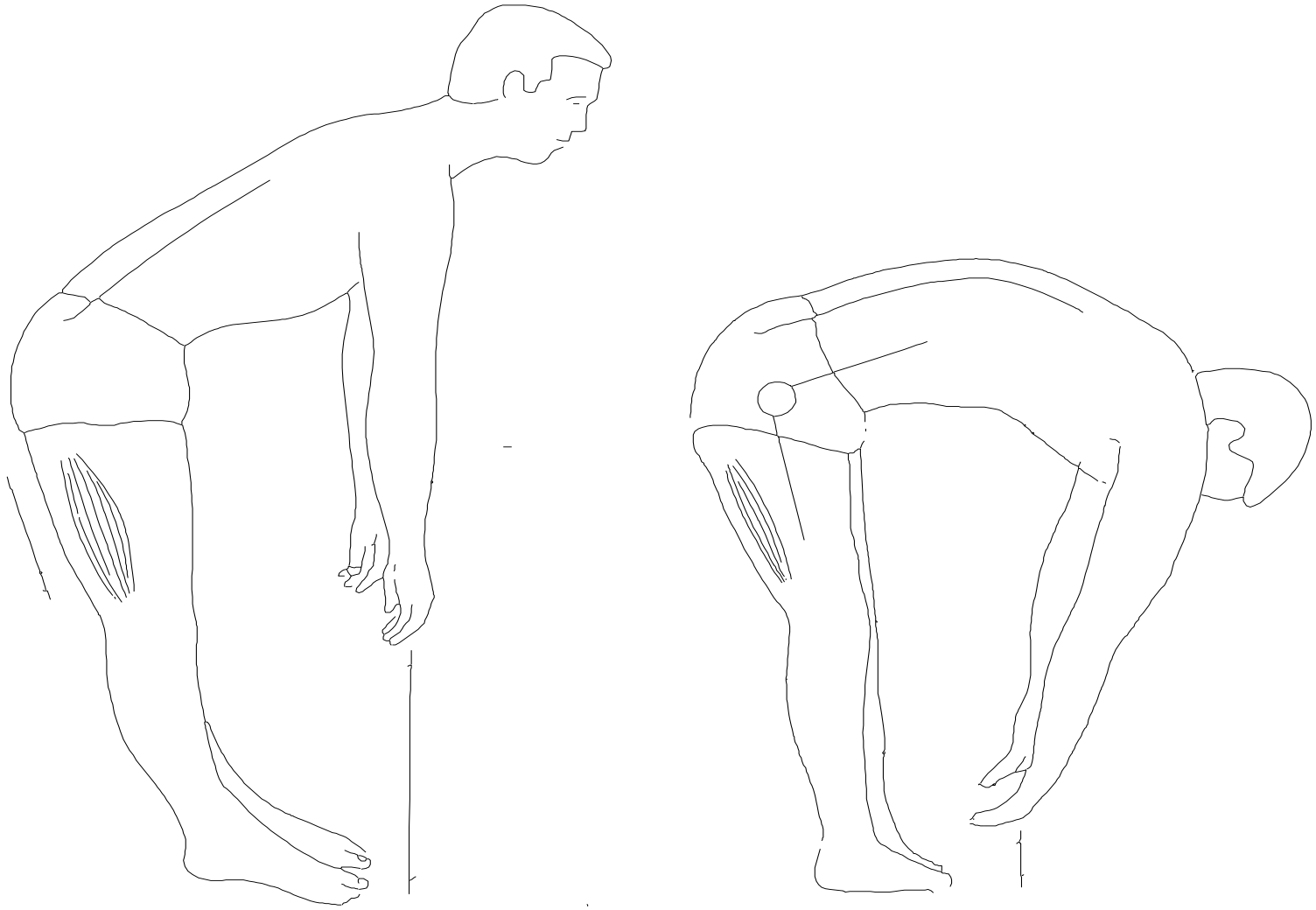
LORDOSIS







Scoliosis VS Trunk list



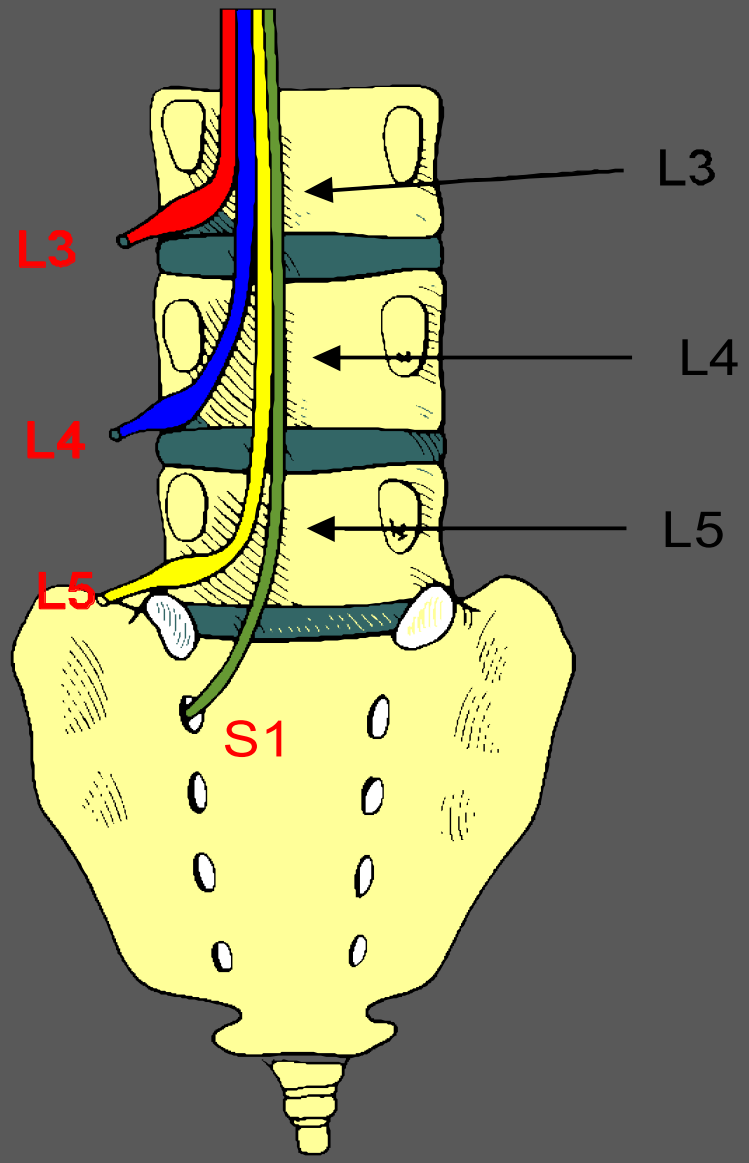
Back flexion and pelvic tilt

« OBJECTIVE » PHYSICAL SIGNS

- ***DYNAMIC SIGNS***
  - Range of Motion
    - Poor validity, reliability and reproducibility
  - Continuous motion
    - « Catch » : segmental instability (?)
    - Pain at extension : spondylolylis (young), stenosis (oder)
    - Abnormal patterns of motion : transient stenosis

« OBJECTIVE » PHYSICAL SIGNS

- ***NEUROLOGICAL SIGNS***
  - Modified reflexes
  - Sensory deficits
  - Modified muscle strength
  - Painful Straight Leg Raising : ispilateral and crossed
  - ...


L3
L4
L5
L3
L4
L5
S1

Mainly a psychiatrist !!

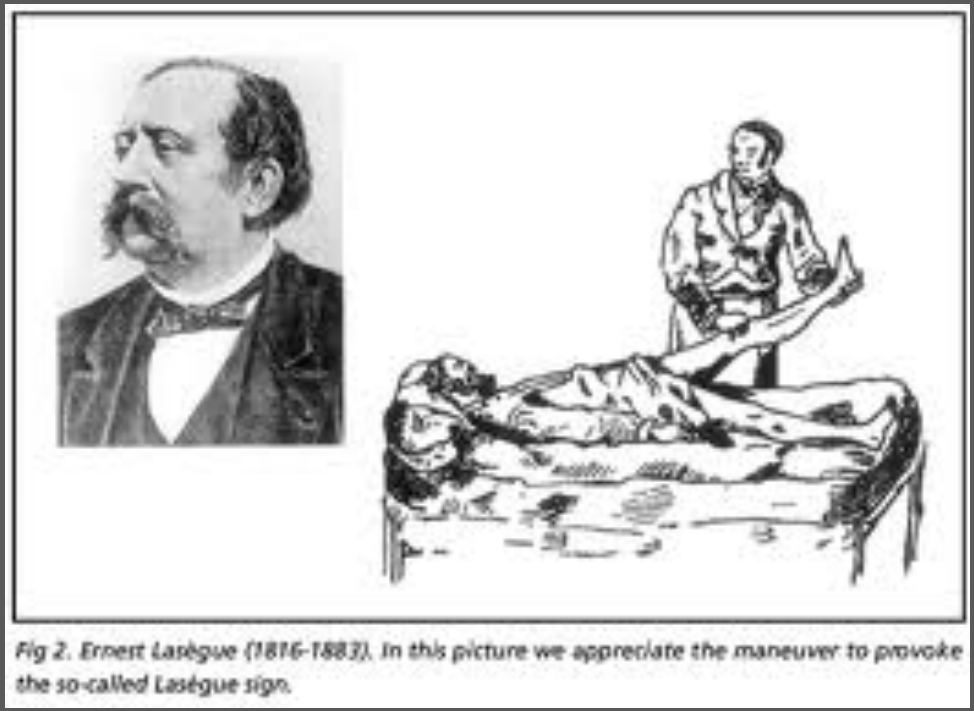
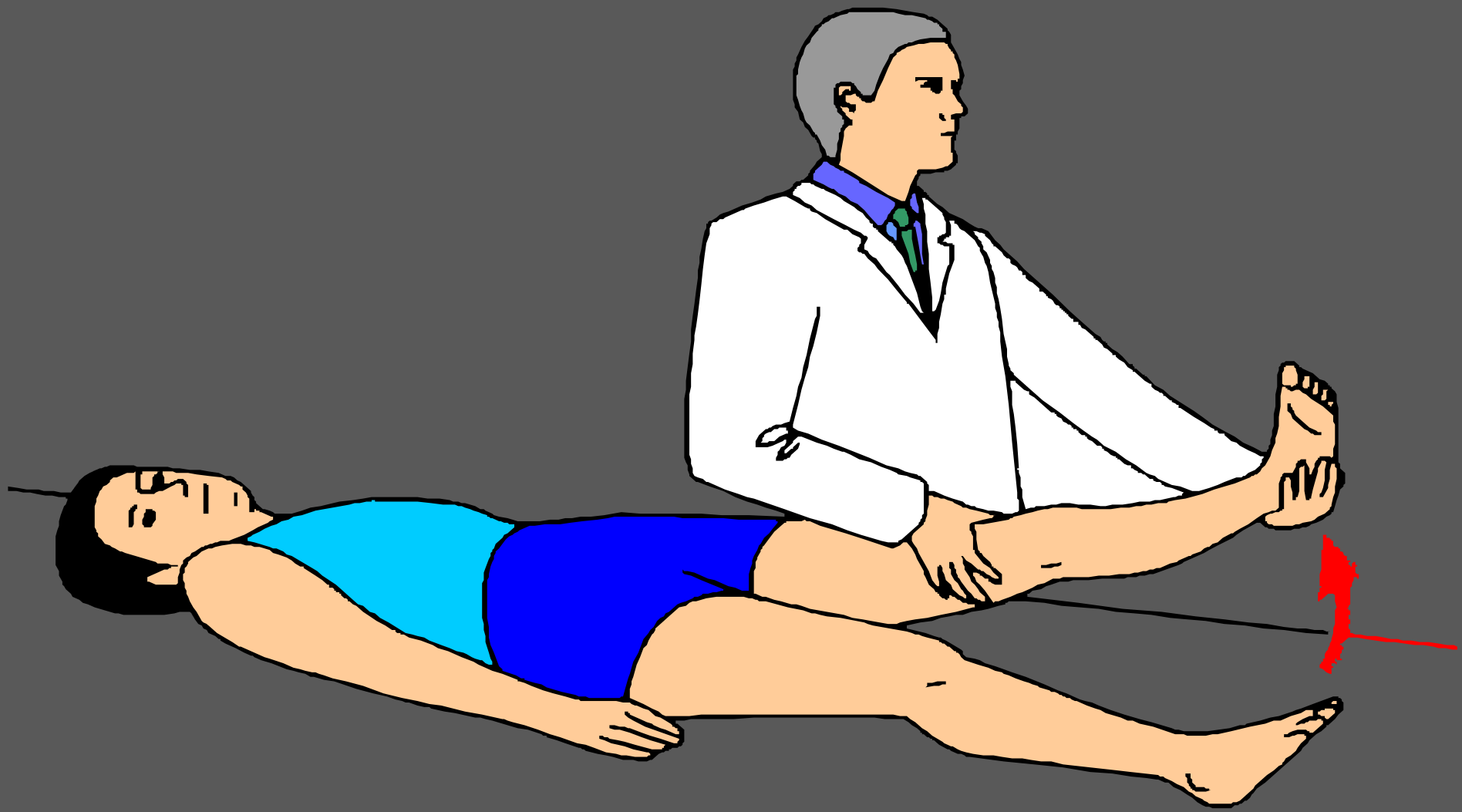
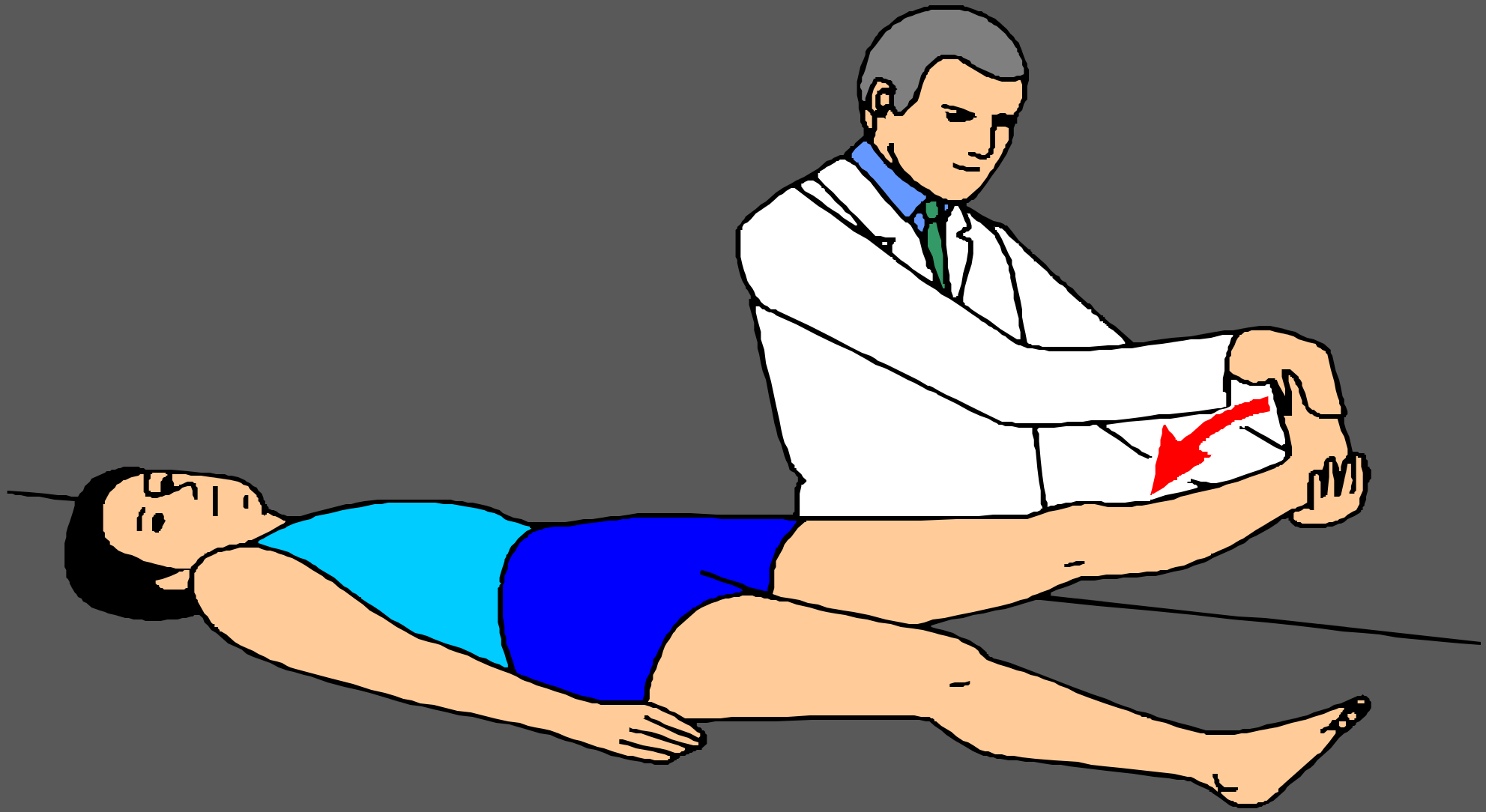
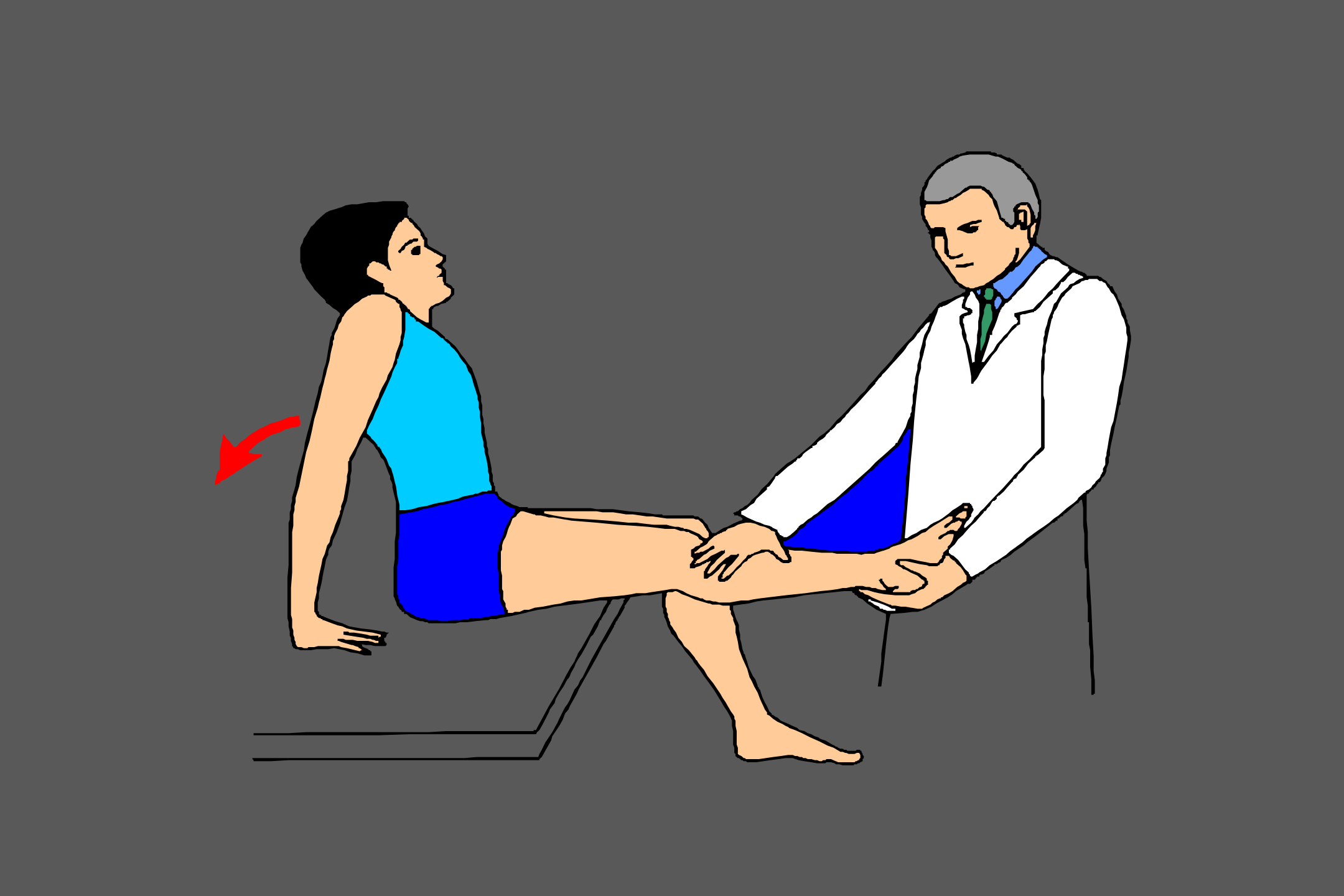


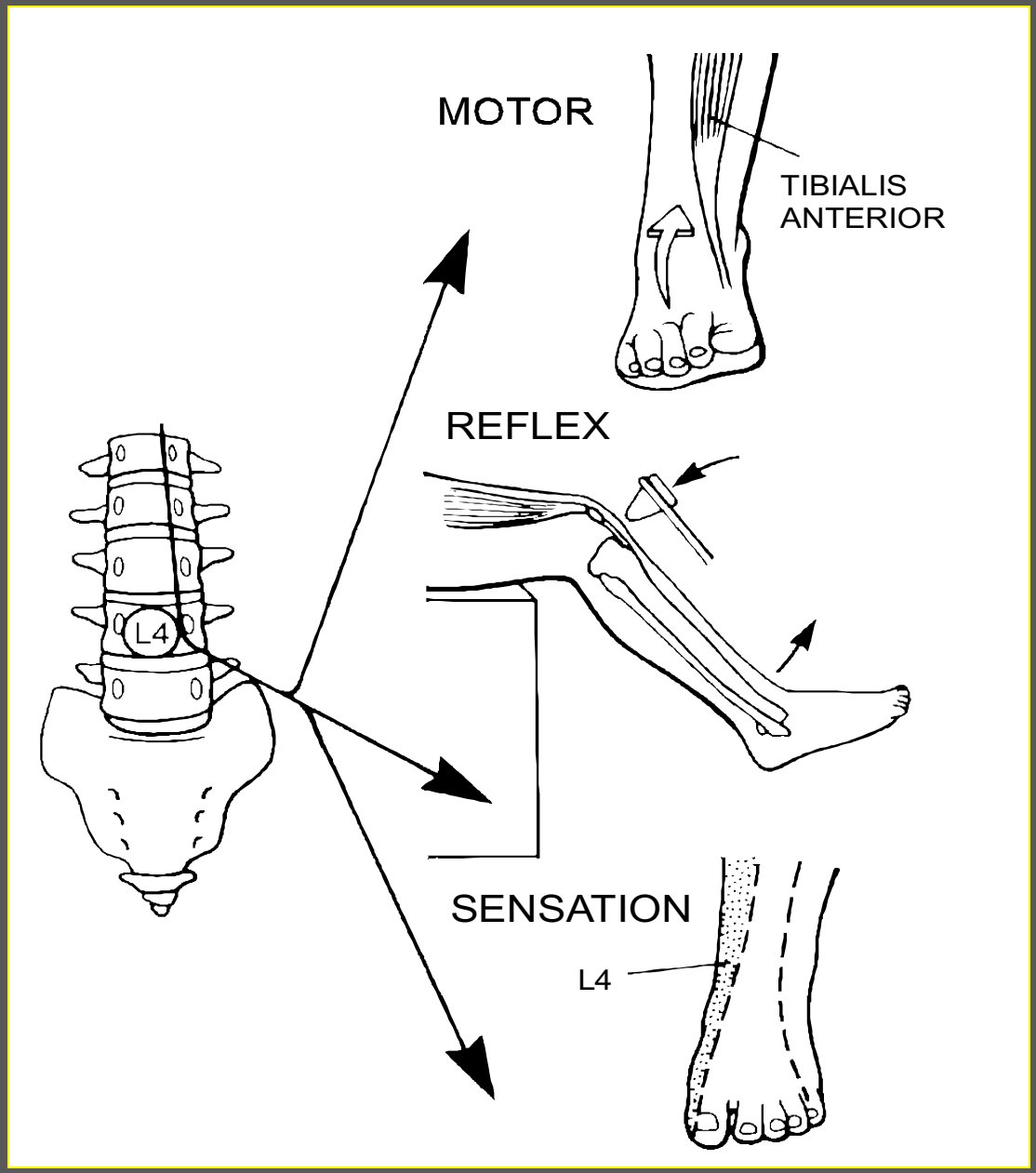
Fig 2. Ernest Lasègue (1816-1883). In this picture we appreciate the maneuver to provoke the so-called Lasègue sign.





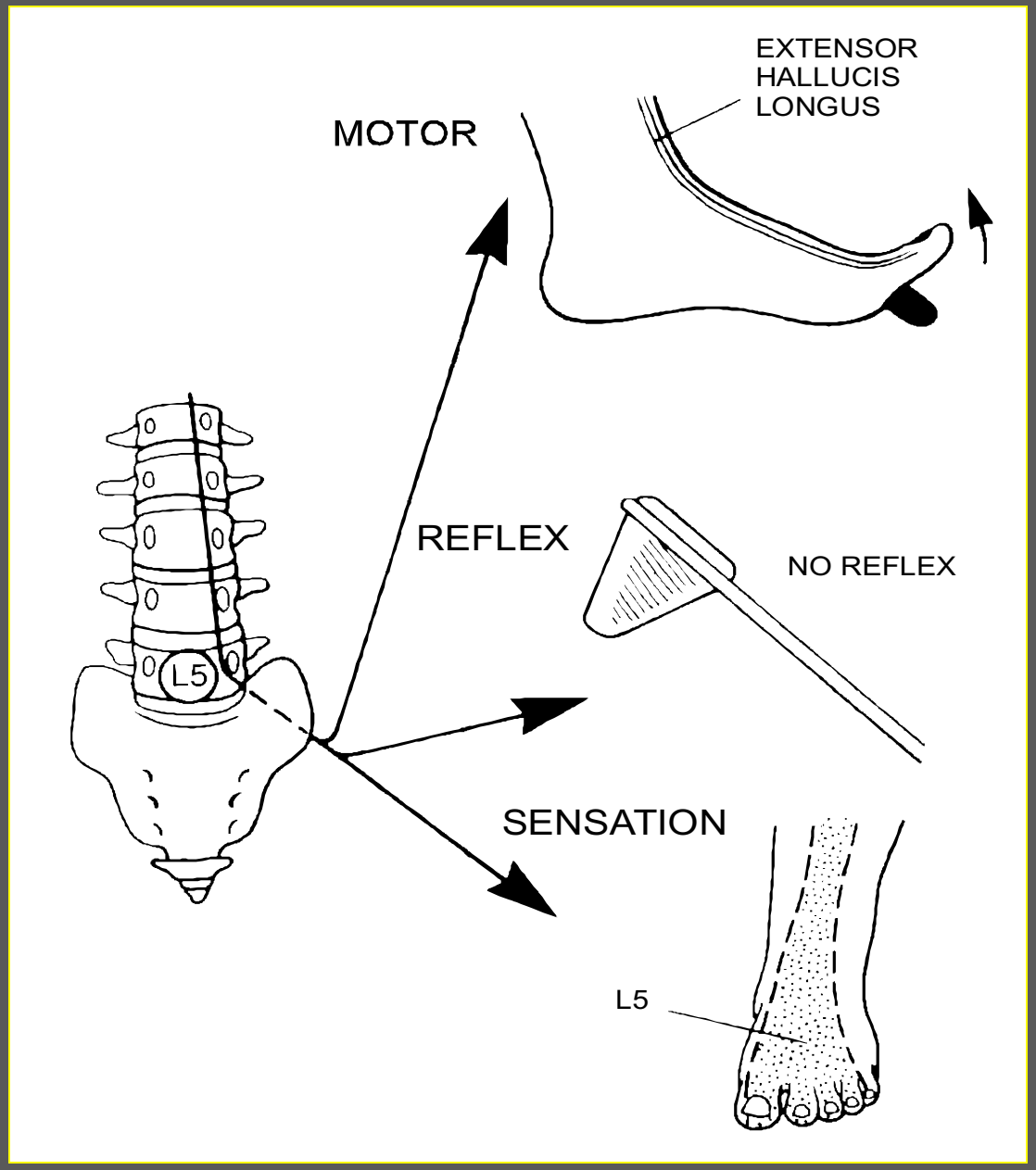


L4



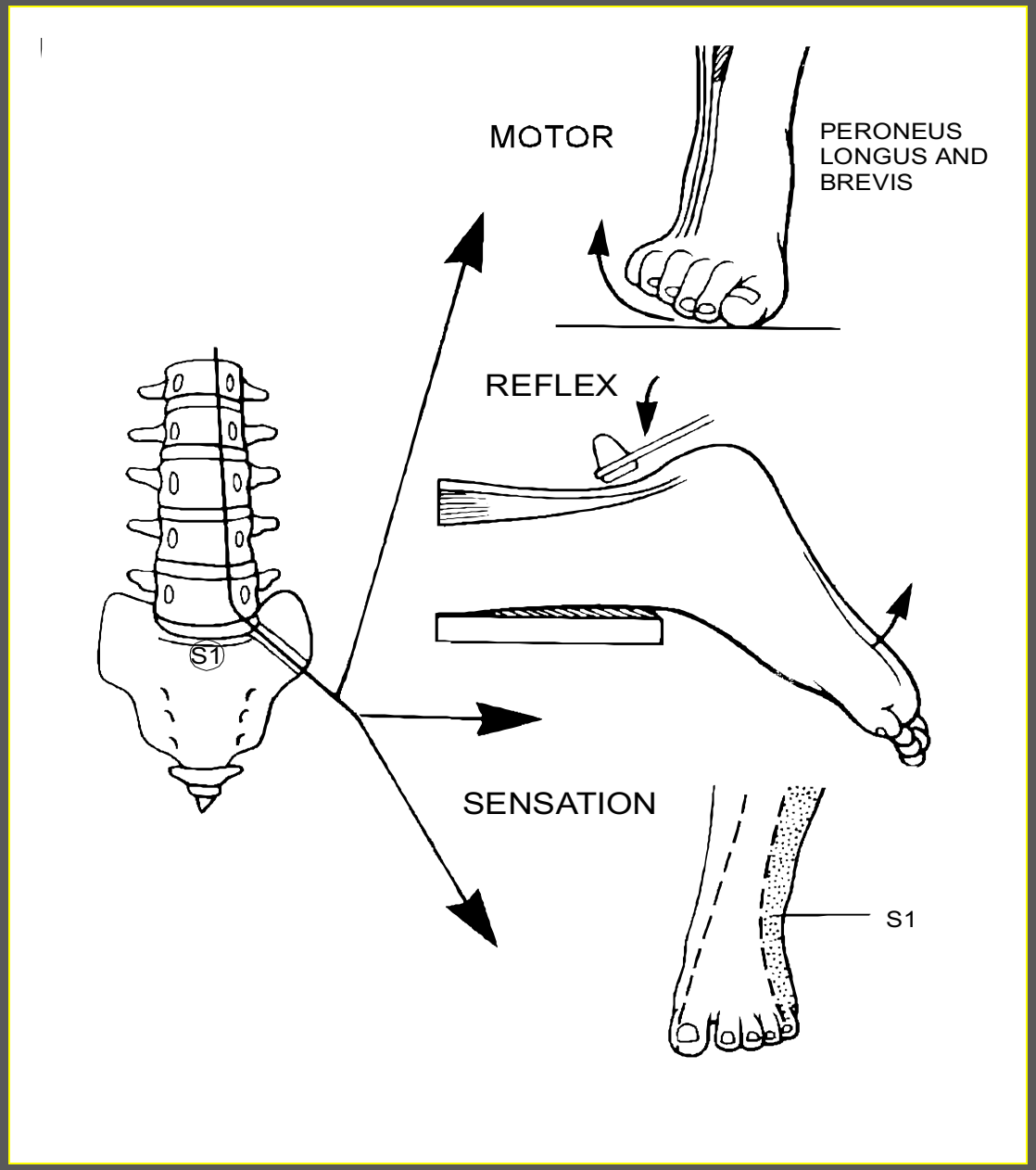
NERVE ROOT
COMPROMISE

L5

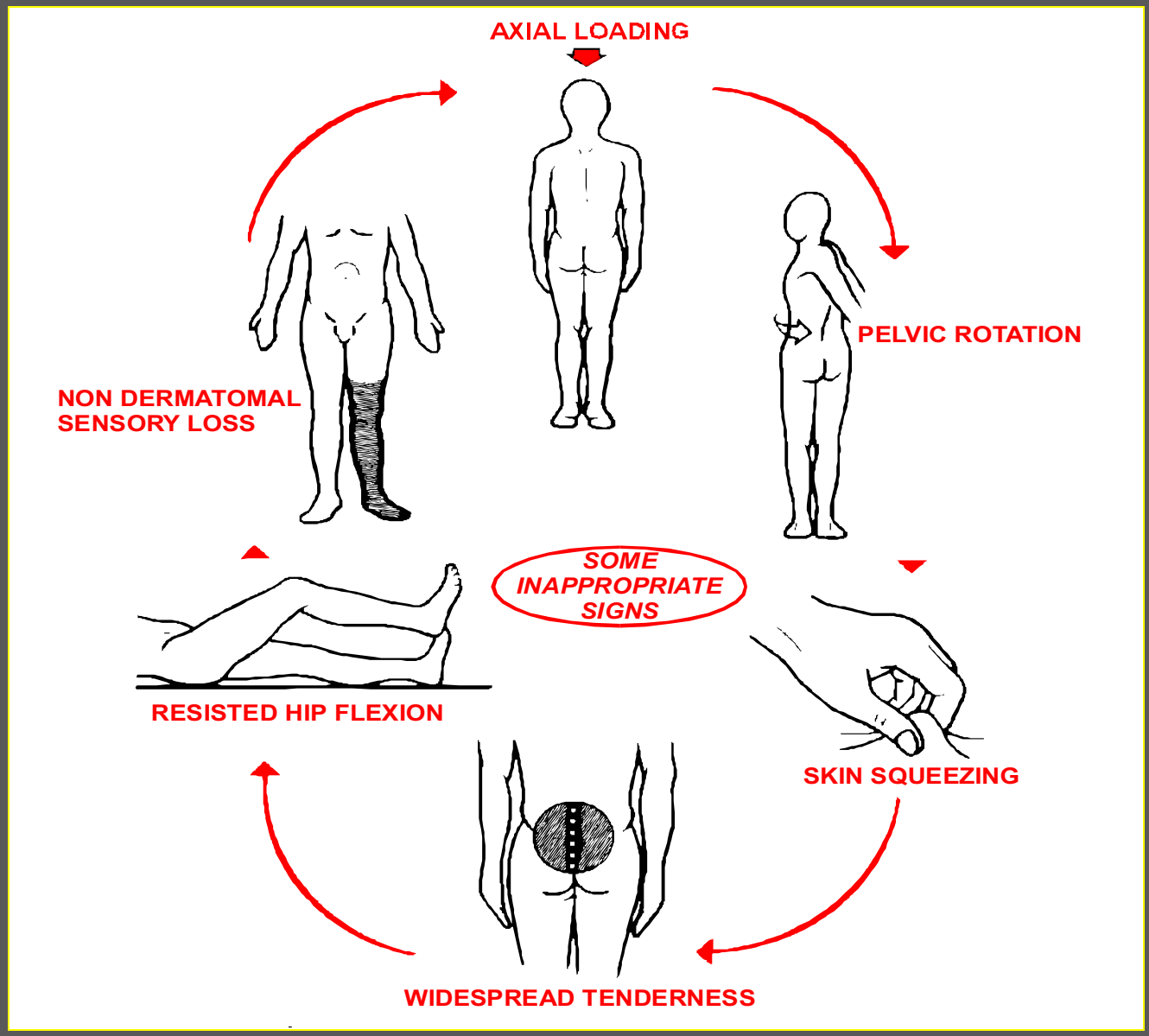


NERVE ROOT
COMPROMISE

S1



NERVE ROOT COMPROMISE



Non organic physical signs (Waddell et al. 1980)

RED FLAGS

History

- ***Possible fracture***
  - Major trauma (vehicle, fall)
  - Minor trauma in older or osteoporotic

RED FLAGS

History

- ***Possible tumor or infection***
  - Age over 50 or under 20
  - History of cancer
  - Fever, chills, weight loss
  - Recent bacterial infection (urinary…)
    - IV drug abuse, immune suppression (steroids, HIV…)
  - Constant unremitting pain
  - Worsening of pain when supine
  - Night pain

RED FLAGS

- ***Possible cauda equina syndrome***

History

  - Saddle anesthesia
  - Bladder dysfunction (retention, incontinence…)
  - Severe or progressive neurological deficit in lower extremities

Examination

  - Anal sphincter laxity
  - Perianal/perineal sensory deficit
  - Major motor weakness, foot drop, quadriceps weakness plantar flexors weakness...

DIAGNOSTIC VALUE

ACCURACY

ACCURACY

- ***SENSITIVITY***
- ***SPECIFICITY***
- ***PREDICTIVE VALUE***

SENSITIVIY OF A FINDING

PROPORTION OF SUBJECT <u>WITH</u> A PATHOLOGY WHO HAVE A <u>POSITIVE</u> FINDING

=

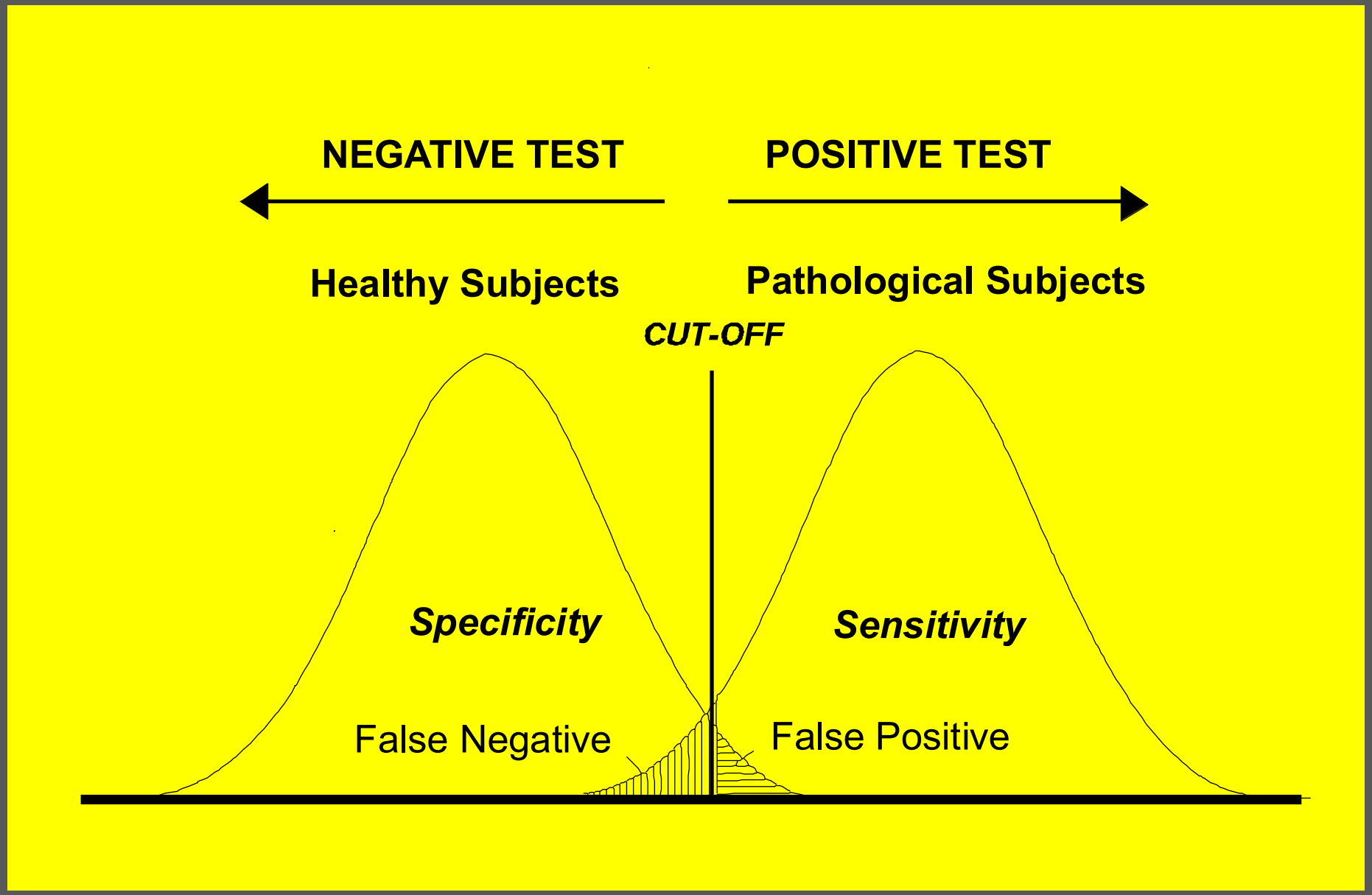
POSITIVE IN DISEASE

SPECIFICITY OF A FINDING

PROPORTION OF PATIENTS <u>WITHOUT</u> A PATHOLOGY WHO HAVE A <u>NEGATIVE</u> FINDING

=

NEGATIVE IN HEALTH


NEGATIVE TEST
POSITIVE TEST
Healthy Subjects
Pathological Subjects
CUT-OFF
Specificity
Sensitivity
False Negative
False Positive

IF VERY HIGH SENSITIVITY

NEGATIVE FINDING

↓

« RULE OUT » PATHOLOGY

=

SnNout

IF VERY HIGH SPECIFICITY

POSITIVE FINDING

↓

« RULE IN » PATHOLOGY

=

SpPin

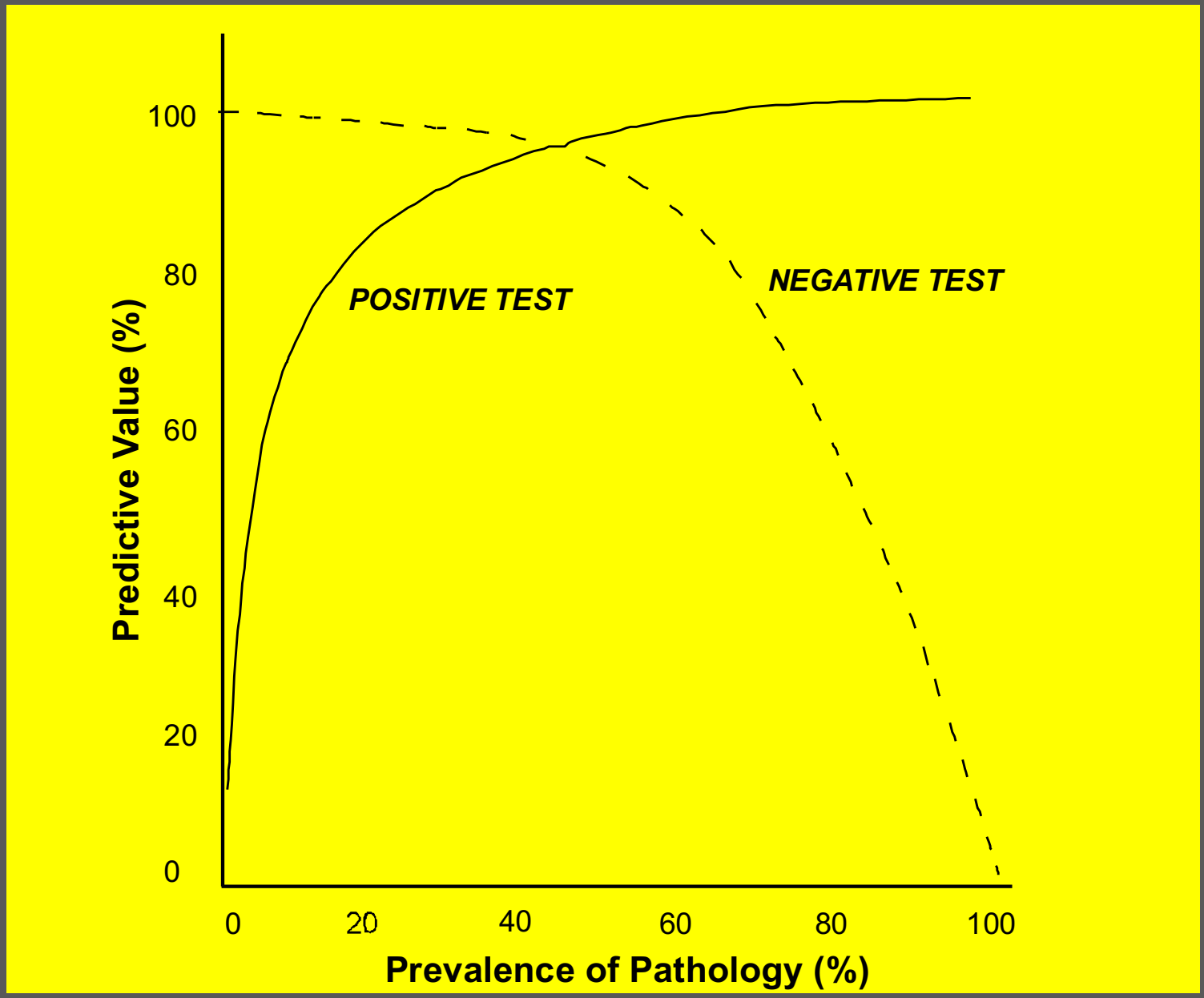
PREDICTIVE VALUE OF A FINDING

TRUE ACCURACY

PROPORTION OF SUBJECTS WITH A <u>POSITIVE</u> FINDING WHO <u>HAVE</u> THE PATHOLOGY

!!! Difficult because high variability, influenced by pathology prevalence in the concerned population.

!! Subject recruitment (selection bias). Clinical skills !!



Relation between prevalence and predictive value (Sn 95 %, Sp 98 %)

ACCURACY OF MEDICAL HISTORY

Suspected Disease	History	Sensitivity	Specificity
CANCER	Age > 50	0.77	0.71
	Prev. cancer history	0.31	0.98
	Unexpl. weight loss	0.15	0.94
	No improv. After 1 mo. therapy	0.31	0.90
	No relief bedrest	0.90	0.46
	Pain > 1 mo	0.50	0.81
	Age >50 or cancer history or weight loss or failure of improvement after 1 mo	1.00	0.60

From : Deyo et al. JAMA 268: 760-5, 1992

ACCURACY OF MEDICAL HISTORY

Suspected Disease	History	Sensitivity	Specificity
ANKYLOSING SPONDYLITIS	Onset < 40 y	1.00	0.07
	Pain not relieved supine	0.80	0.49
	Morning stiffness	0.64	0.59
	Pain > 3 mo	0.71	0.54
	4 of 5 positive answers *	0.23	0.82

* Onset < 40, Began slowly, Persistance > 3 mo, Morning stiffness, Improved by exercice

From : Deyo et al. JAMA 268: 760-5, 1992

ACCURACY OF MEDICAL HISTORY

Suspected Disease	History	Sensitivity	Specificity
OSTEOMYELITIS	IV drugs, Urinary inf., Skin inf.	0.40	NA
COMPRESSION #	Age > 50	0.84	0.61
	Age > 70	0.22	0.96
	Trauma	0.30	0.85
	Corticosteroids	0.06	0.995
HERNIATED DISC	Sciatica	0.95	0.88
SPINAL STENOSIS	Claudication	0.60	NA
	Age > 50	0.90	0.50

From : Deyo et al. JAMA 268: 760-5, 1992

ACCURACY OF PHYSICAL EXAMINATION IN HERNIATED DISC

Examination	Sensitivity	Specificity
Ispilateral SLR	0.80	0.40
Crossed SLR	0.25	0.90
Ankle dorsifl. weakness	0.35	0.70
Great toe ext. weakness	0.50	0.70
Impaired ankle reflex	0.50	0.60
Sensory loss	0.50	0.50
Ankle plantar flex. weakness	0.06	0.95
Quadriceps weakness	0.01	0.99

} Combined (or) specificity = 0.90

From : Deyo et al. JAMA 268: 760-5, 1992

Ratings of available evidence supporting guidelines statements

- ***A***: Strong research based evidence (multiple high quality studies)
- ***B***: Moderate research based evidence (one high quality or multiple adequate studies)
- ***C***: Limited research based evidence (at least one adequate study)
- ***D***: Information that did not meet inclusion criteria as research based evidence

Initial Assessment methods

Agency for Health Care Policy and Research recommendations

- Strength of evidence
  - Age, duration, impact on activiy, response to therapy : B
  - Cancer, weight loss, infection, pain at rest, fever : B
  - Symptoms of cauda equina : C
  - Trauma (related to age) : C
  - Pain drawings, VAS : D
  - SLR in youg adults : B
  - Neurological examination : B

CLASSIFICATIONS

- QUEBEC TASK FORCE CLASSIFICATION
- PYNSENT-FAIRBANK HALL CLASSIFICATION

Table 3.1. Classification of Activity-related Spinal Disorders

Classification	*Symptoms*	*Duration of symptoms from onset*	*Working status at time of evaluation*
1	Pain without radiation	a (<7 days)	W (working)
2	Pain + radiation to extremity, proximally	b (7 days – 7 weeks)	I (idle)
3	Pain + radiation to extremity, distally*	c (>7 weeks)	
4	Pain + radiation to upper/lower limb neurologic signs		
5	Presumptive compression of a spinal nerve root on a simple roentgenogram (ie, spinal instability or fracture)		
6	Compression of a spinal nerve root confirmed by Specific imaging techniques (ie, computerized axial tomography, myelography, or magnetic resonance imaging) Other diagnostic techniques (eg, electromyography, venography)		
7	Spinal stenosis		
8	Postsurgical status, 1 – 6 months after intervention		
9	Postsurgical status, >6 months after intervention 9.1 Asymptomatic 9.2 Symptomatic		
10	Chronic pain syndrome		W (working) I (idle)
11	Other diagnoses		

*Not applicable to the thoracic segment.

Pynsent-Fairbank-Hall Classification of Extraspinal Pain

Level 0	Back pain	
Level 1	Spinal pain, extraspinal pain (genitourinary, gastrointestinal, central nervous system, psychologic)	
Level 2	Back pain Thigh pain Leg or foot pain	
Level 3	Back pain Referred pain Radicular pain	
Level 4	Back pain (pattern 1)—disc pain Back pain (pattern 2)—facet pain Leg pain (pattern 3)—radicular pain Leg pain (pattern 4)—neurogenic claudication Back or leg pain (pattern 5)—abnormal pain-focused behavior	
Level 5	Examples: Discitis (pattern 1) Instability syndrome (pattern 1, pattern 2) Posterior annular tear (pattern 1) Central stenosis (pattern 4) Lateral stenosis (pattern 4) Spondylolysis or spondylolisthesis (pattern 1, pattern 2, pattern 3, pattern 4)	
Level N	***Congenital***	
	Spondylolisthesis	
	Spondylolysis	
	Spina bifida	
	Diastematomyelia	
	Achondroplasia	
	Acquired (Spinal Causes)	
	Infection	Tuberculosis, *Brucella* infection, staphylococcal infection, others
	Neoplasia	Tumors, benign or malignant
	Inflammation	Rheumatoid arthritis, osteoarthritis, Reiter syndrome, ankylosing spondylitis, others
	Degenerative conditions	Disc, facet, arthrosis, spondylolisthesis
	Metabolic disorders	Paget disease, osteoporosis
	Iatrogenic causes	Stenosis, spondylolisthesis, postlaminectomy syndrome
	Trauma	Fracture, posterior annular tear, stress fracture, crush fracture
	Acquired (Extraspinal Causes)	
	Infection	Guillain-Barré syndrome, other viral illness
	Neoplasia	Direct invasion, testicular tumors, lymphomas, etc.
	Inflammation	Rheumatoid arthritis, osteoarthritis, Reiter syndrome, ankylosing spondylitis, others
	Cardiovascular system	Aortic aneurysms, ischemia
	Digestive system	Pancreatitis, gallbladder disease, etc.
	Genitourinary system	Renal pain, uterine pain, etc.
	Central nervous system	Psychologic conditions, central pain syndromes

Pynsent-Fairbank-Hall Classification of Intraspinal Pain

Pattern 1

Pattern 1 is a pain distribution felt most significantly in the back and/or buttocks. The symptoms are aggravated by lumbar flexion and intensify with repeated forward bending or a sustained forward-flexed posture. There can be pain radiation to the leg, occasionally as far as the ankle, but the chief site remains the back or buttocks. Pattern 1 generally has a slow onset, over hours to days, and lasts for an extended period measured from weeks to months. In a few cases, pattern 1 can have a sudden onset and run the brief episodic course more consistent with pattern 2. In this pattern 1 variant, the location of the dominant pain and the aggravating effect of lumbar flexion are unchanged.

Pattern 2

The dominant pain in pattern 2 is again in the back and/or buttocks. Leg symptoms are again common but are secondary. The symptoms are aggravated by lumbar extension, and in contrast to the discomfort associated with joint stiffness, the pain increases when the extensions are repeated. Each episode begins suddenly, within minutes or hours, and lasts for only a week or two. There is an uncommon variation of pattern 2, which is more chronic, developing slowly over several days and lasting for weeks or months, a chronology more typical of pattern 1. The principal features of pattern 2, the pain location and aggravating movement, remain constant.

Pattern 3

Leg-dominant pain is the hallmark of pattern 3. Although associated back pain is unusual, the leg symptoms are clearly predominant. As with pattern 1, the onset is gradual, measured in hours to days, and the duration extends for weeks or months. There is often, although not always, a shift in the dominant pain site from the back to the leg some time after the onset of symptoms. The pain is intensified with lumbar flexion or a flexed position.

The physical examination is marked by positive root irritation signs with or without evidence of a conduction deficit.

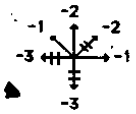
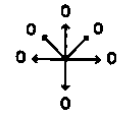
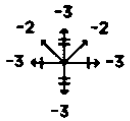
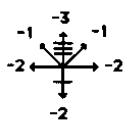
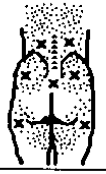
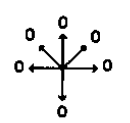
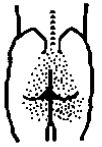
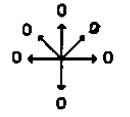
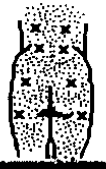
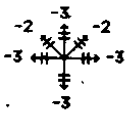
Pattern 4

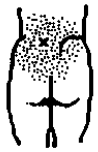
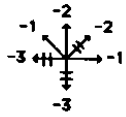
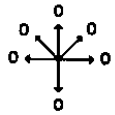
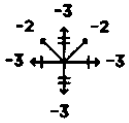
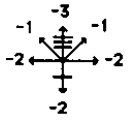
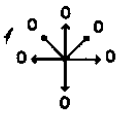
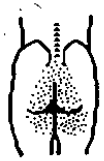
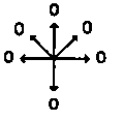
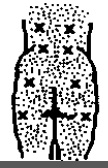
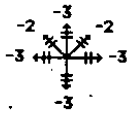
Pain or discomfort felt primarily in the legs is also the mark of pattern 4. Symptoms are produced with activity, classically by walking, and occur within minutes. They are relieved by rest and subside as rapidly as they appear. In contradistinction to the leg symptoms of intermittent vascular claudication, the leg pain in pattern 4 is often controlled only when rest is combined with a change in posture, usually the assumption of a flexed position. Symptoms may be precipitated by extreme sustained lumbar extension. The peripheral circulation is normal.

Pattern 5

Pattern 5 is a pattern of pain associated with an abnormal pattern of behavior. There is an unremitting pain focus, which makes pain the deciding factor in choosing any activity. Without an organic cause, the location of the dominant pain shifts and the array of symptoms expands. Pain is usually present for several months with the conspicuous lack of a clear supportable diagnosis. Multiple medical consultations, repetitive inconclusive investigations, and a panoply of ineffective treatments are the norm. Pattern 5 is almost invariably associated with disrupted sleep. Loss of libido, a deteriorating family situation, unstable employment status, depression, and hostility are common. The premorbid physical abilities are often unwittingly exaggerated. There is an obsession to discover the "real" source of pain, coupled with an unwillingness to consider the possibility of a nonorganic cause.

Making the diagnosis of a primarily behavioral problem requires that the four physical pain patterns and other organic causes of atypical pain are carefully excluded. The diagnosis of pattern 5 is made with reluctance by the clinician and resisted by the patient.

Cause	Pain (⁘) Tenderness (x) Pattern	Painful Arc, ROM Diagram	Special Signs	Radiological Findings	Treatment
Strain syndrome: Acute facet			Sudden, non-traumatic onset List to contralateral side Characteristic painful arc pattern	Normal	Manipulation Mobilization Exercises flexion, rotation, isometrics Back school
Strain syndrome: Postural			Pain on history only Normal back examination Poor posture & body mechanics	Normal	Posture principles Back school Lumbar roll Special chair
Ankylosing spondylitis			Morning stiffness "Jelling" Limited motion entire spine + SI stress test Loss of lordosis Flexed posture	+ X-rays + SI tomograms Vertebral body "squaring" "Bamboo" spine Costovertebral & facet fusion	NSAIDs Heat Exercise: extensor strengthening ROM Flexor stretches Posture training
Compression fracture, osteoporosis			Localized tenderness & paraspinal muscle spasms that correlate with X-ray findings	+ X-rays + Bone scan Decreased bone density (densitometry)	Limited bed rest Limited corset use Exercises: isometric extensor pectoral stretches Posture training Shoe inserts
Tension myalgia (fibrositis)			Increased tenderness in multiple trigger points Increased muscle "tone" Sleep disorder	Normal	Reassurance Relaxation training Posture training Heat & massage Injections Sleep Rx (Tricyclic Rx) Exercise (stretching/fitness)
Pelvic floor myalgia			Normal back examination Tender pelvic floor muscles & attachments on rectal exam + Pyriformis stretch test	Normal	Pelvic floor relaxation training Short wave diathermy Thiele's massage Hydrotherapy
Chronic postoperative LBP			Multiple tender trigger points Skin hyperesthesia "Old" neuro findings	Postoperative & degenerative changes Arachnoiditis on myelogram, CT, MRI	Exercises: strengthening isometrics Fitness program Back school Pain management program

Cause	*Pain (⁘) Tenderness (x) Pattern*	*Painful Arc, ROM Diagram*	*Special Signs*	*Radiological Findings*	*Treatment*
Strain syndrome: Acute facet			Sudden, non-traumatic onset List to contralateral side Characteristic painful arc pattern	Normal	Manipulation Mobilization Exercises flexion, rotation, isometrics Back school
Strain syndrome: Postural			Pain on history only Normal back examination Poor posture & body mechanics	Normal	Posture principles Back school Lumbar roll Special chair
Ankylosing spondylitis			Morning stiffness "Jelling" Limited motion entire spine + SI stress test Loss of lordosis Flexed posture	+ X-rays + SI tomograms Vertebral body "squaring" "Bamboo" spine Costovertebral & facet fusion	NSAIDs Heat Exercise: extensor strengthening ROM Flexor stretches Posture training
Compression fracture, osteoporosis			Localized tenderness & paraspinal muscle spasms that correlate with X-ray findings	+ X-rays + Bone scan Decreased bone density (densitometry)	Limited bed rest Limited corset use Exercises isometric extensor pectoral stretches Posture training Shoe inserts
Tension myalgia (fibrositis)			Increased tenderness in multiple trigger points Increased muscle "tone" Sleep disorder	Normal	Reassurance Relaxation training Posture training Heat & massage Injections Sleep Rx (Tricyclic Rx) Exercise (stretching/fitness)
Pelvic floor myalgia			Normal back examination Tender pelvic floor muscles & attachments on rectal exam + Pyriformis stretch test	Normal	Pelvic floor relaxation training Short wave diathermy Thiele's massage Hydrotherapy
Chronic postoperative LBP			Multiple tender trigger points Skin hyperesthesia "Old" neuro findings	Postoperative & degenerative changes Arachnoiditis on myelogram, CT, MRI	Exercises: strengthening isometrics Fitness program Back school Pain management program

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Classification of Low Back Pain From Dynamic Motion Characteristics Using an Artificial Neural Network

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Study Design. Data were collected from 183 subjects who were randomly assigned to the training and test groups. During testing of the classification system, knowledge of the low back pain condition or motion characteristics of the patients in the test group was not made available to the system.

Objectives. To determine specific characteristics of trunk motion associated with different categories of spinal disorders and to determine whether a neural network analysis system can be effective in distinguishing patterns.

Summary of Background Data. Numerous studies have established the difficulty of evaluating lower back pain. Imaging techniques are expensive and ineffective in many cases. A technique for evaluation of lower back pain was developed on the basis of analysis of such dynamic motion features as shape, velocity, and symmetry of movements, using a neural network classification system.

Methods. Dynamic motion data were collected from 183 subjects using a triaxial goniometer. Features of the movement were extracted and provided as input to a two-stage neural network classifier governed by a radial basis function architecture. After training, the output of the classifier was compared with Québec Task Force pain classifications obtained for the patients. Linear and nonlinear classification techniques were compared.

Results. The system could determine low back pain classification from motion characteristics. The neural network classifier produced the best results with up to 85% accuracy on novel "validation" data.

Conclusions. A neural network based on kinematic data is an excellent predictive model for classification of lower back pain. Such a system could markedly improve the management of lower back pain in the individual patient. [Key words: low back pain, motion analysis, neural network, nonlinear classification, symmetry analysis] **Spine 1997;22:2991–2998**

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Acknowledgment date: July 11, 1997.
Acceptance date: July 11, 1997.
Device status category: 1.

Low back pain (LBP) is one of the most frequent and most disabling health problems affecting society, and its incidence appears to be increasing. This complaint will affect 80% of the people in the United States and Great Britain at some point during their lifetimes.[4,5,45] In Sweden in a 10-year period, 1% of all workdays lost annually were attributable to low back conditions.[16] The average sick leave was 36 days, which is similar to the 24 days' leave in the United States and the 33 days' leave in Great Britain. Forty percent of the workers affected with LBP were disabled for less than 1 week, whereas 9.9% were disabled for more than 6 months. No other disease category was responsible for a greater number of days lost from work.[1] During 1983 and 1984, all patients who were granted sick leave for LBP in Göteborg, Sweden, were analyzed in a prospective study containing 49,000 subjects from 20 to 65 years of age.[2] A total of 7,526 sick leaves for LBP were reported during an 18-month period. Fifty-seven percent of patients recovered in 1 week, 90% in 6 weeks, and 95% after 12 weeks. At the end of a year, 1.2% were still unable to work.

Approximately 2.4 million Americans are disabled because of LBP disorders, the major cause of disability in those less than 45 years old.[21,23,24] In Belgium, the average cost of a worker's compensation claim resulting from back pain is twice that of the average for all compensation cases.[19] In the same country, a recent population study showed that 22% of adults report daily LBP.[44]

Evaluation

Although there are sophisticated diagnostic means, in 80% of cases there is no obvious source of nociception.[14] In addition, the correlations between abnormal radiologic findings and low back complaints are highly inconsistent.[7,20] In most cases, LBP is considered to be mechanical or functional. Therefore, functional assessment may be considered useful for investigating those low back troubles. Functional assessment is an interesting method for differentiating between different types of nonspecific low back troubles and to prescribe and follow up specific rehabilitation. It is also interesting to differentiate between nonspecific back troubles and specific diseases in basic LBP screening before going to more

NEURAL NETWORK ANALYSIS

- Continuous back motion data (B-Tracker)
- Quebec Task Force classification and regroupment of categories (QTF 1, 2-4, 5-7, 8-9, 10)
- Artificial neural network analysis
- Results : 72 % accuracy

- ***Reliable and reproducible clinical presentation canvas do exist for the small minority of back troubles were a objective pathological origin can be demonstrated***

- ***In the vast majority of back pain patients presenting non specific low back pain there are no such reliable and reproducible clinical presentation canvas***


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