S-100, Serum

Background: S-100 is a 21kD protein, belongs to calcium binding protein family indicating a role as an intracellulare calcium receptor. Functions are regulation of cell differentiation and proliferation and the protein is interacting with the p53 tumor suppressor. Two subunits (alpha and beta) are forming the isoforms S-100B (beta-beta), S-100A (alpha-beta), S-100A1 (alpha-alpha). High concentrations of S-100B occur in astrocytes of the CNS, low concentrations in the peripheral nervous system. S-100A1 occurs in cardiac muscle cells, in the kidney and in the skin. S-100A is synthesized by malignant melanoma.

S-100 is used in the diagnosis, as a prognostic parameter and therapy monitoring of the malignant melanoma. S-100 is highly specific. In melanomas, S-100 correlates to the tumor stage: Stage I only up to 10% of the patients display elevated levels, stage IV the diagnostic sensitivity is 30%-90%.

S-100 is also used in neurodegenerative diseases and neuro-destructive injuries (ischemia, infections, and traumas) and to assess the function of blood brain barrier. Injuries are followed by an increase within several hours, peaking at day 1-3 and decline with a half life time of 2-3h. There is a correlation between seize of the neuro destruction assessed by CT, clinical status and prognosis for rehabilitation.

Limitations: In carcinomas of the lung, gastrointestinal tract, urogenital tract or other sites or autoimmune diseases the max. concentration may reach 0.6 µg/L but is usually in the range of healthy individuals. As an exception S-100 may reach levels of 2 µg/L in severe bacterial infections. Elevated levels may occur in cirrhosis, renal failure, myocardial infarction.

Sampling: 1 mL serum

Reference Interval:

Male:	< 0.18 µg/L
Female:	< 0.15 µg/L

Salicylate, Serum or Plasma

Synonyms: Anacin®, ASA, Ascriptin®, Aspirin®, Bufferin®, Easprin®, Ecotrin®, Empirin®, Measurin®, Synalgos®, ZORprin®

Background: Salicylate is the active compound from aspirin as an analgesic, antipyretic and anti-inflammatory drug. Acute poisoning include clinical signs such as nausea, vomiting, hyperpnea, tinnitus, convulsions as well as hypocalcemia, respiratory alkalosis, dehydration, oliguria, metabolic acidosis, hepatotoxicity. Chronic poisoning may include fever, vomiting, tachypnea. Half life: 2-3h; protein binding 90%-95%; volume distribution 0.1-0.3 L/kg.

Sampling: 2 mL serum, time to peak concentration 1-2h, optimal sampling 4-6h after dosage.

Reference Interval:

100-150 µg/mL	antiplatelet, antipyretic, analgesic effects
150-300 µg/mL	antirheumatic, anti-inflammatory effects
250-400 µg/mL	therapy of rheumatic fever; Mildly toxic causing tinnitus, dizziness, nausea, sweating, headache, diarrhea, tachycardia;

Toxic: more than 400 µg/mL, may be lethal at 700 µg/mL. Half life 2-3h, prolonged up to 20h at toxic levels.

Salivary amylase, Serum see Amylase, Isoenzymes, Serum

Salmonella, Culture and Serology

Background: Salmonella are gram negative, lactose negative rods, possessing the O cell wall antigen, the flagellar H antigen and the capsular Vi antigen which are used for taxonomic purposes. Salmonella are transmitted by food and water contaminated by human or animal wastes. Besides S. typhi, all other species have human and animal (poultry, eggs, dogs, snakes, lizards, iguanas) reservoirs.

Salmonella species are the cause of enterocolitis, enteric fever and septicemia with metastatic infections such as osteomyelitis. There are three methods for naming salmonellae. The most common the Kaufman and White scheme assign different species names (usually named for the city in which they are first isolated) to each serotype, approx 1500 species are known so far.

For clinical purposes there are typhoidal species (S. typhi and S. paratyphi) and non typhoidal species (many strains of S. enteritidis).

Clinical courses: Enterocolitis is characterized by invasion of the epithelial cell layer and the infection is limited to the mesenteric lymph nodes with rare bacteremia. Dose of infection is high, 100 000 organisms are necessary, in contrast to Shigella sp, were 10 organisms are sufficient to start an enterocolitis.

Typhoid forms are characterized by few intestinal symptoms and spread by the blood circulation to the gall bladder, the liver and spleen. A chronic carrier state may develop.

Septicemia accounts for 5%-10% of Salmonella infections and may lead to osteomyelitis, pneumonia, meningitis, typically in children with sickle cell anemia.

Sampling: Culture: In enterocolitis, the organism is most easily isolated from a stool sample. At least 3 samples of approx. 2 g of fresh stool to send to the laboratory. In a carrier state, stool cultures are also appropriate.

In enteric fevers, a blood culture is most likely to reveal the organism during the first 2 weeks of disease.

Serology: If there is no recovery of salmonella species in blood or stool, serology may establish the diagnosis. At least two specimens are necessary, 2-3 weeks apart.

Reference Interval:

Culture:	Report on diagnostic finding		
Serology:	Differentiation of antibody classes against S. typhimurium and S. enteritidis:		
	IgA, IgG, IgM antibody	negative	< 1.0 COI
		borderline	1.0-1.2 COI
		positive	> 1.2 COI

Scl-70 Antibody

Related Information: Antinuclear Antibody
Jo-1 Antibody
SS-A/Ro and SS-B/La Antibodies
Ribonucleoprotein U1-snRNP Antibody
Smith (SM) Antibody

Synonyms: Progressive Systemic Sclerosis Antibody,
Topoisomerase I Antibody, Scleroderma Antibody

Background: Topoisomerase I is a 100kD nuclear enzyme responsible for twisting and untwisting the DNA helix during replication. Scl-70 antibody is directed against a 70 kDa proteolytic fragment of the Topoisomerase.

Systemic sclerosis is a chronic disorder characterized by diffuse fibrosis of the skin and internal organs occurring in the third to fifth decades with a 2-3 times higher incidence in women. Two forms are known: A limited form in 80% of the patients, and diffuse form in 20% of the patients. The limited form is characterized by calcinosis cutis, Raynaud's phenomenon, esophageal motility disorder, hardening of the skin of the face and hands. The diffuse form is characterized by skin changes also at the proximal extremities and trunk, tendon friction, rubs, cardiac diseases such as pericarditis, heart block, myocardial fibrosis, diverticulosis of the gut, renal involvement.

30%-60% of the patients with diffuse scleroderma have antibodies to Scl-70 of the IgG class, infrequently of the IgA and IgM class. Scl-70 antibody positive patients with scleroderma are more likely to have visceral involvement such as pulmonary fibrosis as well as shin diseases. 60-95% of the patients with scleroderma are ANA positive, 25%-35% are Rheuma factor positive

Sampling: 1 mL serum

Reference Interval: Negative

Scleroderma Antibody see Scl-70 Antibody

Selenium (Se), Serum or Plasma

Related Information: Selenium (Se), Urine

Background: As a constituent of glutathione peroxidase and iodothyronine deiodinase it is an important essential trace element of human nutrition. Se is incorporated into other proteins as selenomethionine. There are ongoing discussions on the role in anticancer (colorectal, lung, prostate) and cardiovascular diseases.

In long term parenteral nutrition Se levels should be monitored, useful in diagnosis of cardiovascular disease of unknown cause.

Deficiencies, which may be endemic in regions where soil Se is low, thus present in the food chain, can come into clinical attention by whitening in the nail beds, erythrocyte macrocytosis, cardiomyopathy, painful week muscles, skin or hair depigmentation and elevation of transami-

nases and creatinine kinases.

Se is lowered in HIV infection, severe illnesses, kwashiorkor, inflammation of the bowl, renal failure, low protein diet, phenylketonuria, maple syrup urine disease, low birth weight. Levels are increased under glucocorticoid therapy. Toxic sate is characterized by nausea, diarrhea, mental changes, peripheral neuropathies, hair loss.

Sampling: 2 mL serum or plasma. Containers must be trace metal free. Use powder free gloves.

Reference Interval: Serum 60-130 µg/L. For whole blood 40% higher.
Serum reflects resent intake, red cells reflects long term intake.
Critical values: > 500 µg/L

Selenium (Se), Urine

Related Information: Selenium (Se), Serum or Plasma

Background: Reflects resent intake, if patient is in Se balance.

Limitations: Do not use spot values, urine Se is higher after a meal, fasting urine may give better results, for assessing Se state of the patient, 24 h urine is necessary. Usually, Se loss in the urine is an overflow loss, although Se is excreted by the skin and stool. In chronic hepatic diseases, selenoproteins are produced in insufficient quantities and Se serum concentrations are reduced.

Sampling: Collect 24h urine in an acid washed plastic urine container. Since hair shampoos contain Se, avoid contamination by hairs. Ship a 10 mL aliquot to laboratory.

Reference Interval: 5-30 µg/24h
Toxic: probably > 500 µg/L

Serotonin, Blood

Related Information: 5-Hydroxyindoleacetic Acid (5-HIAA), Quantitative, Urine

Synonyms: 5-HT; 5-Hydroxytryptamine, Urine

Background: Chromaffin cells of the intestinal tract and in central or peripheral neurons synthesize serotonin from tryptophan. May be used in the diagnosis of carcinoid syndrome, but urinary 5-Hydroxindoleacetic acid is more sensitive.

Sampling: 3 mL of ETDA blood, freeze plasma within 4h, stable 7 days at -20°C, ship frozen

Reference Interval: 50–240 µg/L

Sex Hormone Binding Globulin (SHBG), Serum

Background: The major fraction (98%) circulating in the blood of testosterone is bound to SHGB. SHBG is decreased in obese individuals, during steroid therapy and in nephrotic syndrome. Hyperthyreosis, hepatitis, cirrhosis, estrogen and antiepileptic therapy increase serum SHBG. Useful in the determination of free testosterone under conditions mentioned above to achieve a precise estimation of testosterone.

Sampling: 1 mL serum

Reference Interval:		
	Male	10–73 nmol/L
	Female	16–120 nmol/L
	Gravidity	200–700 nmol/L

SGPT see Alanine Aminotransferase (ALT), Serum

Shigella, Culture and Serology

Background: Shigella species organisms are a non fermenting gram negative, non glucose fermenting nonmotile and non H_2S producing rods. Four groups of O polysaccharide antigen are known: A,B,D, and D. Shigella species have no other but human reservoirs and no chronic carrier state. Transmission by the fecal oral route. Outbreaks are food born and second waterborne by low dose of infection (100 organisms). Children account for 50% of infections.

Clinically after an incubation period of 1-4 days fever, abdominal cramps and bloody diarrhea in mild to severe forms depending on the age (in children and elderly patients more severe) occurs. Shigella dysenteriae causes a more severe disease than Shigella sonnei does. Inflammation and local ulceration of the ileum and colon occurs, but the organism does not enter the blood stream. Shiga-toxin is not necessary to invade the gut wall, only non-invasive strains are non-pathogenic.

Treatment: Mild forms are self limiting after 2-4 days, severe forms ciprofloxacin may be indicated.

Sampling: Culture: Fresh stool; Serology: 1 mL serum. Early and reconvalescent serum 2 weeks apart recommended.

Reference Interval: Serology: Widal's reaction: < 1:50
Test includes: Sh. sonnei, Sh. flexneri, Sh. dysenteriae

Sm Protein (Smith) see Smith (SM) Antibody

Smith (Sm) Antibody

Related Information: Antibodies, dsDNA and Antibodies, ssDNA
Antinuclear Antibody

Background: Smith antibodies recognize at least 6 different proteins, which are complexed (snRNP's) with small (less than 300 nucleotides) nuclear RNA fragments (snRNA). The snRNP's are U1-, U2,-U4-, U6- ; the most important proteins within theses complexes are B' (a 29kDa protein) , B (a 28kDa protein), and D (a 16kDa protein).

The Smith antigen belongs to the group of extractable nuclear antigens (ENA), which includes also SS-A/Ro, and SS-B/La antigens and nuclear ribonucleoprotein (RNP) antigens.

Useful in confirming the diagnosis of systemic lupus erythematosus since SM antibodies are highly specific for systemic lupus erythematosus (SLE). Smith antibodies are rarely drug induced LE.
Sm antibodies are present in 10%-20% of Caucasian patients with SLE, in 30%-40% of Asian and African patients and up to 60% in young black females with SLE.

Sampling: 1 mL serum

Reference Interval: Negative: < 10 U/mL

Smooth Muscle Antibodies (SMA)

Related Information:
Alanine Aminotransferase (ALT), Serum
Alkaline Phosphatase, Serum
Antimitochondrial Antibodies
Antinuclear Antibody
Aspartate Aminotransferase (AST), Serum
Bilirubin, Fractionated, Serum
Hepatitis A Antibodies, IgG and IgM (IgG anti-HAV, IgM anti-HAV)
Hepatitis B Virus DNA Detection (HBV-DNA)
Hepatitis B (HBV), Serology and Antigen Detection
Hepatitis C Antibody (Anti-HCV) or Genotyping
Hepatitis C Virus RNA Quantification (HCV-RNA)
Hepatitis D Serology
Hepatitis E Antibody (Anti-HEV
Liver Kidney Microsomal Antibodies (LKM Antibodies)
Soluble Liver Antigen (SLA)-Antibody (Anti-SLA)

Background: SMA are IgG or IgM class antibodies, directed against microfilamental F-actin, which is present in all smooth muscles.
Useful parameter to differentiate between autoimmune hepatitis types and other forms of hepatitis such as chronic viral hepatitis (Hepatitis B, D, C), drug induced chronic hepatitis (methyldopa, nitrofurantoin, propylthiouracil), Wilson's disease, alpha$_1$ antitrypsin deficiency.
SMA are found in 50-80% of patients with autoimmune hepatitis type 1 and type 3.
Type 1 is also associated with ANA, high IgG immunoglobulin levels, and occurrence of other extrahepatic autoimmune syndromes but nearly always lacking Liver Kidney Microsomal Antibodies of the type 1 (LKM-1). In 10% of the type-1 patients Soluble Liver Antigen (SLA)-Antibodies (Anti-SLA) are detectable.
Limitation: Positive test results may occur in patients with primary biliary cirrhosis, rarely in viral hepatitis, infectious mononucleosis, tumors, alcoholic cirrhosis and in up to 5% in healthy individuals.

Sampling: 1 mL serum

Reference Interval: Titers:
< 1:20 negative
≥ 1:20 positive
> 1:160 chronic aggressive disease

Sodium (Na), Serum

Related Information: Antidiuretic Hormone, Plasma
Chloride (Cl), Serum or Urine or CSF
Lithium (Li), Serum
Osmolality, Serum or Urine
Potassium, Serum or Plasma or Urine
Renin Activity, Plasma
Sodium (Na), Urine
Urea-Nitrogen and Urea, Serum or Plasma
Urea Nitrogen, Urine
Uric Acid, Serum or Urine

Background: Sodium is the most important cation in the extracellular space, whereas potassium in the intracellular space, together with the anions it contributes 95% of the extracellular osmotically activity. The distribution of water between the extracellular and intracellular space varies only by 1-2%.
Calculation of serum osmolality:
mosmol/kg H_2O = 1.86 x sodium + glucose + urea (if in mmol/L) or
mosmol/kg = 1.86 x sodium + 0.056 x glucose + 0.17 x urea + 9 (if sodium in mmol/L and glucose in mg/dL and urea in mg/dL)

1. Hyponatremia (< 136 mmol/L, severe <120 mmol/L)
   Hyponatremia occurs, if net H_2O uptake exceeds H_2O excretion.
   Causes:
   1.1. hypotonic hyponatremia with decreased volume of extracellular fluid
      1.1.1 Renal sodium losses:
      Diuretics
      Salt wasting syndrome
      Osmotic diuresis (by mannitol, glucose)
      Glucocorticoid deficiency
      Ketonuria
      Renal tubular acidosis
      1.1.2 Extrarenal losses:
      Diarrhea and vomiting
      Pancreatitis, peritonitis, bowl obstruction, burns, trauma by sequestration in third space.

   1.2 Hypotonic hyponatremia with increased volume of extracellular fluid
      Congestive heart failure
      Cirrhosis
      Nephritic syndrome
      Renal impairment
      Pregnancy

1.3 Hypotonic hyponatremia with normal volume of extracellular fluid
Syndrome of inappropriate antidiuretic hormone in malignancies, pulmonary diseases (infectious, respiratory failure, ventilation) and in central nervous system disorders (psychosis, inflammation, stroke, hemorrhage, trauma, demyelinating diseases) and drugs (carbamazepine, chlorpropamide, clofibrate, nicotine, opiates, oxytocin, phenothiazine, tricyclics), hypothyreosis, postoperative state.

2. Hypernatremia
Diabetes insipidus (neurogenic, post traumatic, tumors, tuberculosis, sarcoidosis, aneurysms, meningitis, Guillain Barré syndrome, nephrogenic in renal diseases, hypercalcemia, hypokalemia, drugs).
Idiopathic hypernatremia
Osmotic diuresis due to hyperglycemia, mannitol, diarrhea, sweating.

Sampling: 1 mL serum

Reference Interval:

		mmol/L
adult		135-145
infants	0-7 days	133-146
	7-31days	134-144
	1-6month	134-142
	6 month -1 year	133-142
	older than 1 year	134-143

Sodium (Na), Urine

Related Information:
Aldosterone, Serum or Plasma or Urine
Chloride (Cl), Serum or Urine or CSF
Lithium (Li), Serum
Osmolality, Serum or Urine
Potassium, Serum or Plasma or Urine
Renin Activity, Plasma
Sodium (Na), Serum
Urea-Nitrogen and Urea, Serum or Plasma
Urea Nitrogen, Urine
Uric Acid, Serum or Urine

Background: Useful parameter in the assessment of volume disorders, acute renal failure, oliguria and in the diagnosis of hyponatremia.

Urinary Sodium (mmol/L)	serum sodium	state	cause
> 30	hyponatremia	hypovolemic	diuretics, mineralocorticoid deficiency, salt wasting nephritis
> 30	hyponatremia	hypervolemic	acute or renal failure
> 30	hypernatremia	hypovolemic	osmotic diuresis
> 30	hypernatremia	hypervolemic	primary/secondary aldosteronism, Cushing s syndrome, sodium bicarbonate or sodium administration
> 20	hyponatremia	euvolemic	hypothyroidism, glucocorticoid deficiency syndrome of inappropriate antidiuretic hormone drugs, water intoxication
< 30	hyponatremia	hypovolemic	vomiting, diarrhea, burn wounds
< 30	hypernatremia	hypovolemic	excessive sweating, diarrhea
< 10	hyponatremia	hypervolemic	liver cirrhosis, nephritic syndrome, cardiac failure

Urinary sodium varies in central and nephrogenic diabetes insipidus and hypodipsia
Urinary sodium > 40 mmol/L may indicate acute tubular necrosis

Sampling: Ship to laboratory a 5 mL aliquot of a 24h urine, note total quantity.

Reference Interval: Excretion varies with dietary intake. Diurnal variation with a low excretion during the night.

male	average 160 mmol/24h	range 135-210 mmol/24h
female	average 135 mmol/24h	range 115-170 mmol/24h

Soluble Liver Antigen (SLA)-Antibody (Anti-SLA)

S-T

Related Information:
Antimitochondrial Antibodies
Antinuclear Antibody
Anti Liver/Kidney Microsomal Antibodies, Anti LMK-1 antibodies
Bilirubin, Fractionated, Serum
Parietal Cell Antibody
Smooth Muscle Antibodies
Thyroglobulin Antibody
Thyroperoxidase Autoantibody

Background: Autoimmune hepatitis is classified within 3 categories:

Type 1: or lupoid hepatitis: Smooth muscle cell antibodies (SMA) or antinuclear antibodies (ANA), as well as in 10% antibodies to SLA (hepatocyte cytokeratins 8 and 18) are present.

Female preponderance, juvenile age or 45-70 years old, normal IgA levels, pro gression to cirrhosis possible.

Type 2: patients have anti liver/kidney microsomal antibodies (anti LKM-1 antibodies).

Type 2a patients are 2-15 years old and have no SMA.

Type 2b patients are older than 40 years. Type 2b is associated with hepatitis C virus.

Type 3: patients produce anti SLA , anti SMA and antimitochondrial antibodies (AMA), but not with anti LMK-1 antibodies. Type 3 show a female preponderance, aged 30-50 years, normal IGA levels, often also with extrahepatic manifestation.

Sampling: 1 mL serum, keep cool!

Reference Interval: Negative: < 20 E/mL

Soluble Transferrin Receptor, Serum or Plasma

Related Information: Ferritin, Serum or Plasma
Hemochromatosis DNA
Iron (Fe), Serum or Urine
Transferrin and Total Iron Binding Capacity, Serum

Synonyms: Transferrin Receptor, soluble; sTfR

Background: sTfR is a truncated, smaller (proteolytic cleaved by 100 amino acids) form from the cellular transferrin receptor, originating from normoblasts. The transferrin receptor was first isolated from serum in 1990 after discovery in 1986. Increasing iron deficiency up regulates cellular transferrin receptors and sTfR. The marker can be used to differentiate between iron deficiency anemias, with sTfR increase, from anemia in chronic diseases, with normal sTfR values. In patients with inflammatory diseases such as rheumatoid arthritis, sTfR is unaffected by acute phase responses and therefore superior to ferritin or transferrin determination.

High turnover erythropoiesis also increases sTfR. The test is considered a sensitive early indicator of iron deficiency.

Also it is useful in monitoring erythropoietic response to erythropoietin together with serum ferritin and reticulocyte hemoglobin content.

The ratio of serum transferrin receptor to serum ferritin gives an estimation of body iron in mg per kg of body weight.

Less specific but in combination with other parameters used in: autoimmune hemolytic anemia, sickle cell anemia, hereditary spherocytosis, beta thalassemia, alpha-thalassemia, polycythemia vera, vitamin B-12 deficiency, folic acid deficiency.

Sampling: 1 mL serum. Blood specimen is stable for 1h, serum must be separated, transported to the lab or frozen. Specimen cannot be processed if severe hemolysis, icterus or lipemia occur.

Reference Interval: 1.9-5.0 mg/L

Somatomedin C (IGF-1), Serum or Plasma

Related Information: Insulin-Like Growth Factor Binding Protein 3 (IGF-BP3), Serum
Somatotropin, Serum

Synonyms: Insulin-Like Growth Factor-1; IGF-I; Sm-C; Sulfation Factor

Background: Used in diagnosis of diagnosis of acromegaly and monitoring of growth hormone treatment. Low values are in hypopituitarism, malnutrition, delayed puberty, diabetes mellitus, cirrhosis, Elevated values may occur in precocious puberty, pregnancy, obesity, diabetes mellitus, pituitary gigantism, acromegaly, diabetic retinopathy.

In combination with elevated growth hormone levels low IGF-1 levels are seen in Laron dwarfism.

Sampling: 2 mL serum or plasma, overnight fasting is preferable. Separate serum or plasma soon.

Reference Interval:

Children:	1–4 years	49–327 ng/ml
	5–6 years	50–297 ng/ml
	7–9 years	57–388 ng/ml
	10–12 years	88–693 ng/ml
	13–16 years	183–996 ng/ml
Adults:	male	49–342 ng/ml
	female	63–279 ng/ml

Somatomedins see Insulin-Like Growth Factor Binding Protein 3 (IGF-BP3), Serum

Somatotropin, Serum

Related Information: Insulin-Like Growth Factor Binding Protein 3 (IGF-BP3), Serum
Somatomedin C, Serum or Plasma (IGF-1)

Synonyms: Growth Hormone; GH; hGH

Background: The anterior pituitary gland secretes in multiple short spikes GH with a half life of 20 min, under the influence of GH releasing hormone, GH releasing peptide-6 and GH inhibitory hormone (somatostatin) from the pancreas. The maximum occurs during initial phase of deep sleep, smaller amounts are excreted after exercise or eating.

GH affects lipolysis, protein synthesis, cardiac function, red cell mass by direct or indirect action via insulin like growth factor.

Diseases: Pituitary adenomas cause acromegaly, deficiency may cause short statue. In adults, deficiency of GH may cause body fat increase, decrease of muscle mass and strength and bone density, abnormal lipoprotein and carbohydrate turnover.

Since GH secretion is unpredictable random samples may be within the reference range even in patients with acromegaly or other pituitary gland disorders. It is strongly recommended to use one of the dynamic tests for GH insufficiency.

Suppression test is done by 100 g oral glucose after fasting overnight and samples are drawn at baseline, 30 min, 60 min, 120 min: GH is expected to be > 2 ng/ml at 60 min and 120 min.

If a GH deficiency is expected, either use the gold standard the Insulin Tolerance Test or use instead two of the stimulation tests with arginine, glucagons, L-dopa, clonidine, diazepam or pentagastrin. If combining growth hormone releasing hormone, 1 µg/kg body weight with growth hormone releasing peptide-6, 1 microgram/kg body weight, administered IV., the normal GH values are expected to be > 20 ng/ml, values < 10 ng/ml are considered to indicate deficiency.

Sampling: 1 mL serum, stable for 4 h, stable 12 month frozen

Reference Interval:			
	Cord blood		8-41 ng/ml
	Newborn		5-53 ng/ml
	Infant 1-12 month		2-10 ng/ml
	Adult	male	0-4 ng/ml
		female	0-18 ng/ml
	> 60 years	male	1-9 ng/ml
		female	1-16 ng/ml

Squamous Cell Carcinoma Antigen (SCCA)

Background: Lacking sensitivity and specificity, SCCA is not useful in screening procedures but in monitoring therapy and follow ups in patients with squamous cell carcinomas of the cervix, lung, and esophagus, anal and head-neck.

- Carcinoma of the cervix: Incidence of elevated levels in the primary squamous cell carcinoma 65 - 80%, for the type of adeno-squamous cell carcinoma lower (50%), and for the adenocarcinoma 0 - 20%. The specificity varies between 93 - 97%. The incidence of elevated levels increases with the tumor stage: from 0-20% in the early stage to 60 - 100% in stage IV. There is a good correlation between clinical outcome and SCCA serum concentration.

Prognostic value: SCCA > 30 µg/L indicate a short survival and rapid relapse. A predictive threshold for metastasis of the lymph node and prognosis may be estimated by the combination of SCCA (1.5 µg/mL) and CA125 (35 mU/L).

- Squamous cell carcinomas of the lung: Overall sensitivity of SCCA is 30%, 40 - 80% of the patients display elevated levels. There is a correlation for the sensitivity and the stage of the carcinoma, increasing from 30 - 50% in stage I to 70 - 100% in stage IV. CYFRA 21-1 was found to be the most sensitive marker in lung carcinomas (46% with a specificity of 95%) superior to CEA, SCCA and NSE.
- Head and neck carcinomas: Diagnostic sensitivity 30%-80%.
- Carcinoma of the esophagus: Sensitivity 30 - 40%, stage dependent and up to 50% stage IV.

Limitations: Elevated levels (> 2-3 µg/L) occur in benign diseases such as liver cirrhosis (10%), pancreatitis (30 - 60%), renal impairment (up to 80%, correlation with creatinine), chronic lung diseases (up to 40%), in diseases of the female reproduction system (up to 40%), in diseases of the larynx and ears (20 - 46%), in patients with psoriasis (up to 80%).

Sampling: 1 mL serum

Reference Interval: Monoclonal test type: 1.4-1.9 µg/L
No increase during pregnancy

SS-A/Ro and SS-B/La Antibodies

Related information: Cardiolipin Antibody
Antibodies, dsDNA and Antibodies, ssDNA
Antinuclear Antibody
Jo-1 Antibodies
Scl-70 Antibody

Background: Sjoegren syndrome is an autoimmune disorder characterized by dryness of the eyes, mouth and other areas covered by mucous membranes associated frequently with rheumatoid arthritis and other autoimmune diseases such as SLE, primary biliary cirrhosis, scleroderma, polymyositis, Hashimoto thyroiditis, and pulmonary fibrosis. The disorder predominates in women with a 9:1 ratio and occurs in most cases between the age of 40-60 years. Sjoegren's syndrome is linked to HLA-DR-2 and DR-3 antigens.

Laboratory results include mild anemia, leucopenia, eosinophilia, polyclonal hypergamma-globulinemia, rheumatoid factor positivity in 75-95% of the patients, and antinuclear antibodies in 95%, Ku antibodies may be present in 20% of the population.

Antibodies directed to SS-A/Ro are present in 70 - 100% of primary and in 40 - 70% of secondary Sjoegren's syndrome patients. Antibodies to SS-A/Ro are strongly associated with neonatal lupus in babies born to mothers with SLE, characterized by congenital heart block (by SS-A antibodies binding to the conducting tissue) and photosensitive dermatitis for the first 6 month of life caused by maternal IgG crossed the placenta.

Antibodies to SS-B/La are present in 60 - 90% in primary and 30 - 60% of secondary Sjoegren's syndrome.

Anti-Sm, Anti SCL-70, Anti Jo-1 are absent in Sjoegren's syndrome

Sampling: 1 mL serum

Reference Interval:			
	SS-A/Ro	negative:	< 5 U/mL
	SS-B/La	negative:	< 5 U/mL

ss-DNA-Antibody see Antibodies, ssDNA

S-T

Stool, Microbiology

Overview: Please see Germ differentiation of:
Salmonella
Shigella
Yersinia enterocolitica
Campylobacter jejuni / coli,
Dyspeptic E. coli, E. coli 157 (EHEC),
Clostridium difficile
Candida species

Trichosporon spp
Geotrichum candidum
Clostridium difficile toxin A and B
Detection of: Rota-, adeno- and astrovirus, norwalk-like-Virus
Parasite
Helminth eggs

Sampling: approx. 2 g stool in sterile tube

Streptococcus pneumoniae, Serology see Pneumococcal Antibody, Serology

Synovial Fluid Analysis

Related Information: Chlamydia
Borrelia, Serology
Neisseria gonorrhoeae
Rheumatoid Factor, Serum or Body Fluid
Uric Acid, Serum or Urine

Synonyms: Knee fluid

Background: Useful in the diagnosis of rheumatic disease and diseases causing joint symptoms, increase in joint fluid, destructions in the joint space such as gout, infection, pseudogout. Most helpful in infections of the joint, less valuable in previously established diagnosis of rheumatic disease.

In gout, patients are mostly male (male to female ratio 7:1), middle aged, or postmenopausal women, with typical first metatarsophalangeal joints, midfoot ankles knees and wrist, erosions of displaced joints, inflammation with monosodium urate crystals, and possibly underlying diabetes, obesity, hypertension, hyperlipidemia.

In calcium pyrophosphate dehydrate crystal deposition disease, male to female ratio is 1.5:1, mostly elder patients, with no hyperuricemia, typically localized at the knees, wrists, metacarpophalangeal joints, elbows, shoulders. X-ray presenting as chondrocalcinosis and inflammation. Possibly underlying diseases are hyperparathyroidism, hemachromatosis, hyper-magnesemia, hyperphosphatasia, and hypothyroidism.

Decreased glucose indicates inflammation, but only if compared to serum glucose. High LDH but normal serum LDH indicates rheumatoid arthritis, infectious arthritis or gout; it is normal in degenerative joint diseases.

In gonococcal infection of the joint, synovial fluid white cell count averages 50 000 cells/µL and positive gram strains in 25% of the cases. Nongonococcal infectious arthritis may be caused by Staphylococcus aureus in immunocompromised or due to trauma. Less frequent, Streptococci sp and gram negative Bacilli are isolated.

Lyme disease has to be considered if eosinophile count in the synovial fluid exceeds 2%.

60% of Whipple disease patients present with arthritis. DNA for Tropheryma whippelii is tested positive in the synovial fluid as well as neutrophil counts are elevated.

Sampling: If Neisseria gonorrhoeae infection is suspected, Thayer Martin media agar is best inoculated with joint fluid at the bedside.

For microscopy and analysis: 1 mL synovial fluid (or less) in sterile tube and 1ml (or less) in EDTA tube for cell count.

Reference Interval:		
	Cell numbers:	up to 200/µl (mean 75/µl)
	Total protein:	11–22 g/L
	Uric acid:	3–7 mg/dL
	Glucose:	60–95 mg/dL
	Lactate:	9–16 mg/dL
	LDH:	< 200 U/L

Tacrolimus (FK 506), Whole Blood

Related Information: Cyclosporine A (monoclonal)

Synonyms: FK-506; Prograf®

Background: FK-506 is a macrolide lactone immunosuppressant used in renal, liver, heart, lung, bone marrow transplants and in the treatment of atopic dermatitis. Tacrolimus is more active than cyclosporine, but also nephrotoxic, so co administration is not recommended and kidney function has to be closely monitored.

At least 9 metabolites are known mainly produced by the cytochrome P-450 system.

Bioavailability 5-70%; urinary excretion < 1%; plasma binding 70-99% mainly to albumin and alpha-1-acid glycoprotein; volume of distribution 0.7-1.4 L/kg increased in cirrhosis; half life time 8-17h increased in cirrhosis; peak time 1.1-1.9h, peak concentration 21-41 ng/ml after a single 7 mg dose. Steady state reached within 2-3 days.

Sampling: 1 ml whole EDTA blood. Whole blood recommended since tacrolimus binds to erythrocytes and lipoproteins. Plasma levels are up to 20% lower.

Reference Interval:		
	Therapeutic:	Range 3-20 ng/mL through
	for liver transplants	4-10 ng/mL
	for renal transplants	6-12 ng/mL
	for pancreas transplants	10-18 ng/mL
	for bone marrow	10-20 ng/mL

Teicoplanin, Serum

Synonyms: Targocid®

Background: Close to vancomycin, it is a glycopeptide antibiotic composed of 6 glycopeptides. It is effective against Streptococcus species. including Pneumococcus sp., Staphylococcus sp, all aerobe gram positive bacteria including methicillin resistant S. aureus (MRSA),