

FEVER

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Presentation out line

- Normal body temperature
- Description of Fever
- Approach to febrile patient

Normal body temperature regulation

Heat production

- Basal metabolic rate of the body
- Muscle activity
- Endocrine effect: thyroid hormones, epinephrine & norepinephrine.

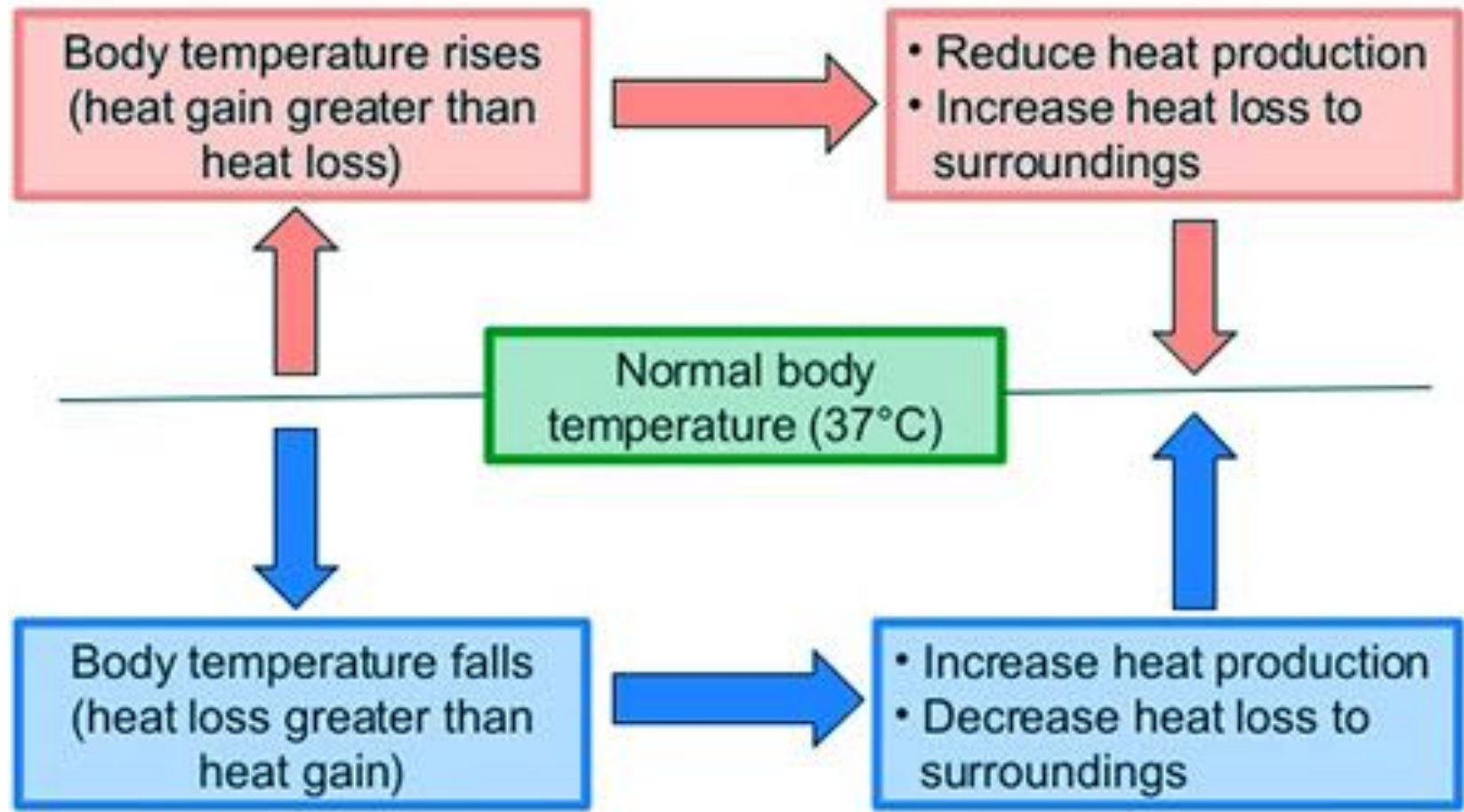


Heat loss Radiation

- Conduction
- Convection
- Evaporation

How the body temperature is regulated

MedicosNotes.com



Body temperature range

Temperature	Degree centigrade	Degree fahreheit
Normal	36.6 - 37.2	98 - 99
Subnormal	<36.6	<98
Febrile	>37.2	>99
Hypepyrexia	>41.6	>107
Hypothermia	<35	<95

To use a rectal thermometer, gently insert the thermometer about 1/2 inch

Hyperthermia

- **Hyperthermia:** an uncontrolled rise in body temperature that exceeds the body's ability to lose heat
- Hyperthermia is not due to fever
- No pyrogenic effects in hyperthermia
- Hypothalamic thermoregulatory set point remain unchanged
- Exogenous heat exposure and endogenous heat production alone or both can cause hyperthermia

Causes of Hyperthermia

Heat Stroke

- **Exertional:** Exercise in higher-than-normal heat and/or humidity
- **Nonexertional:** Anticholinergics, antihistamines; antiparkinsonian drugs, diuretics, phenothiazines

Drug-Induced Hyperthermia

- Amphetamines, cocaine, salicylates, lithium, anticholinergics, sympathomimetics

Neuroleptic Malignant Syndrome

- Phenothiazines, tricyclic dibenzodiazepines, metoclopramide, domperidone

Causes of Hyperthermia

Serotonin Syndrome

- Selective serotonin reuptake inhibitors (SSRIs), monoamine oxidase inhibitors (MAOIs), tricyclic antidepressants

Malignant Hyperthermia

- Inhalational anesthetics, succinylcholine

Endocrinopathy

- Thyrotoxicosis, pheochromocytoma

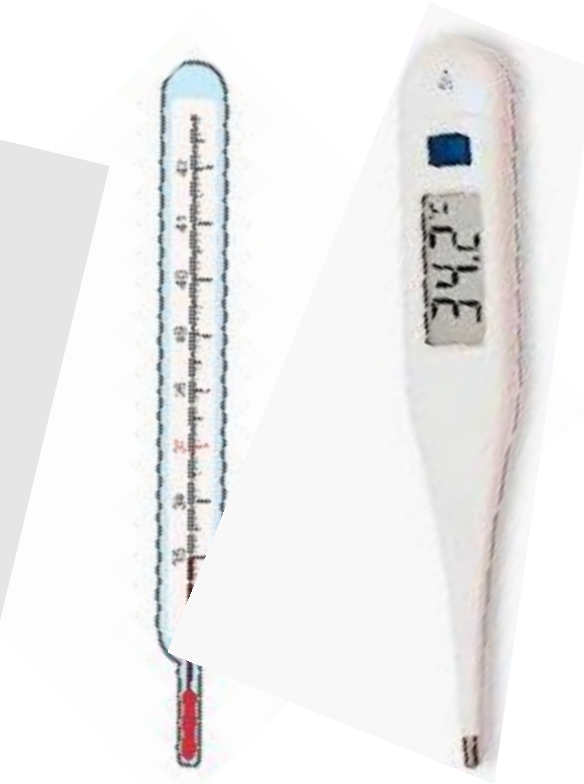
Central Nervous System Damage

- Cerebral hemorrhage, status epilepticus, hypothalamic injury

Recording body temperature: thermometer



Skin patch



Analogue



Digital



Rectal

Rectal thermometers are cherry red to differentiate them from oral or axillary thermometers, have a shorter, squat, pear, bulb. They are not to be used interchangeably with other types of thermometers.

Recording body temperature: thermometer



Infrared thermometer



Aural-thermometer



Recording body temperature

Age	Best site for recording
0 to 3 months	Rectal
3 months to 3 years	Rectal, ear, or armpit
4 to 5 years	Oral, rectal, ear, or armpit
5 years to adult	Oral, ear, or armpit

To use a rectal thermometer, gently insert the thermometer about 1/2 inch

Recording body temperature

- Axillary temperatures are acceptable for children over 3 months of age
- Aural & oral temperatures are recorded over 1 year of age.
- Digital thermometers are the quickest and the easiest to use
- Glass thermometers should not be used because they break easily.
- Forehead strips are unreliable

Fever

- Fever is an elevation of body temperature that exceeds the normal daily variation and occurs *in conjunction with an increase in the hypothalamic set point* (from 37° C to 39° C)

Cause of fever

1. **Infections:** bacterial, virus, protozoa, rickettsias, chlamydiae
2. **Inflammation:** Cellulitis, vasculitis, endocarditis
3. **Immunological disorders:** Connective tissue diseases
4. **Granulomatous disorders:** Sarcoidosis, tuberculosis
5. **Neoplasia:** Br. carcinoma, Hepatoma
6. **Metabolic cause:** gout, pheochromocytoma, hyperthyroidism

Epidemiology

- **Place**
 - South East Asia or Africa
 - Malaria or dengue, encephalitisviral infection
- **Age:** Young patients with prolonged fever
 - Infections
- **Hospitalised patient**
 - Hospital acquired pneumonia, UTI, wound infection, catheter infection, aspiration etc
- **Traveler in tropical countries:** Diarrhoea, Viral hepatitis,
- **Immune compromised patients:** Opportunistic infections

Clinical importance of fever

- Fever is an accurate indicator of physiologic state of the body.
- It indicates organic disease, its severity, course, duration and effect of therapy
- **Detrimental aspect of fever**
 - Dependent on IL1, TNF etc
 - Muscle wasting, myalgia, adipose tissue loss, other metabolic changes, CNS alteration
 - Induce dyselectrolyteemia, cardiac and cerebral functions

Clinical importance of fever

- **Benefits of fever**
 - It increases the immunological activities of PMN leucocytes through IL1
 - Draw attention to its cause
 - Had been used to diminish the manifestation of neurosyphilis or chronic arthritis

Pathogenesis of fever

- Fever is caused by chemical mediators called pyrogens
- Due to effects of pyrogens hypothalamic set point of temperature raises above normal, that causes

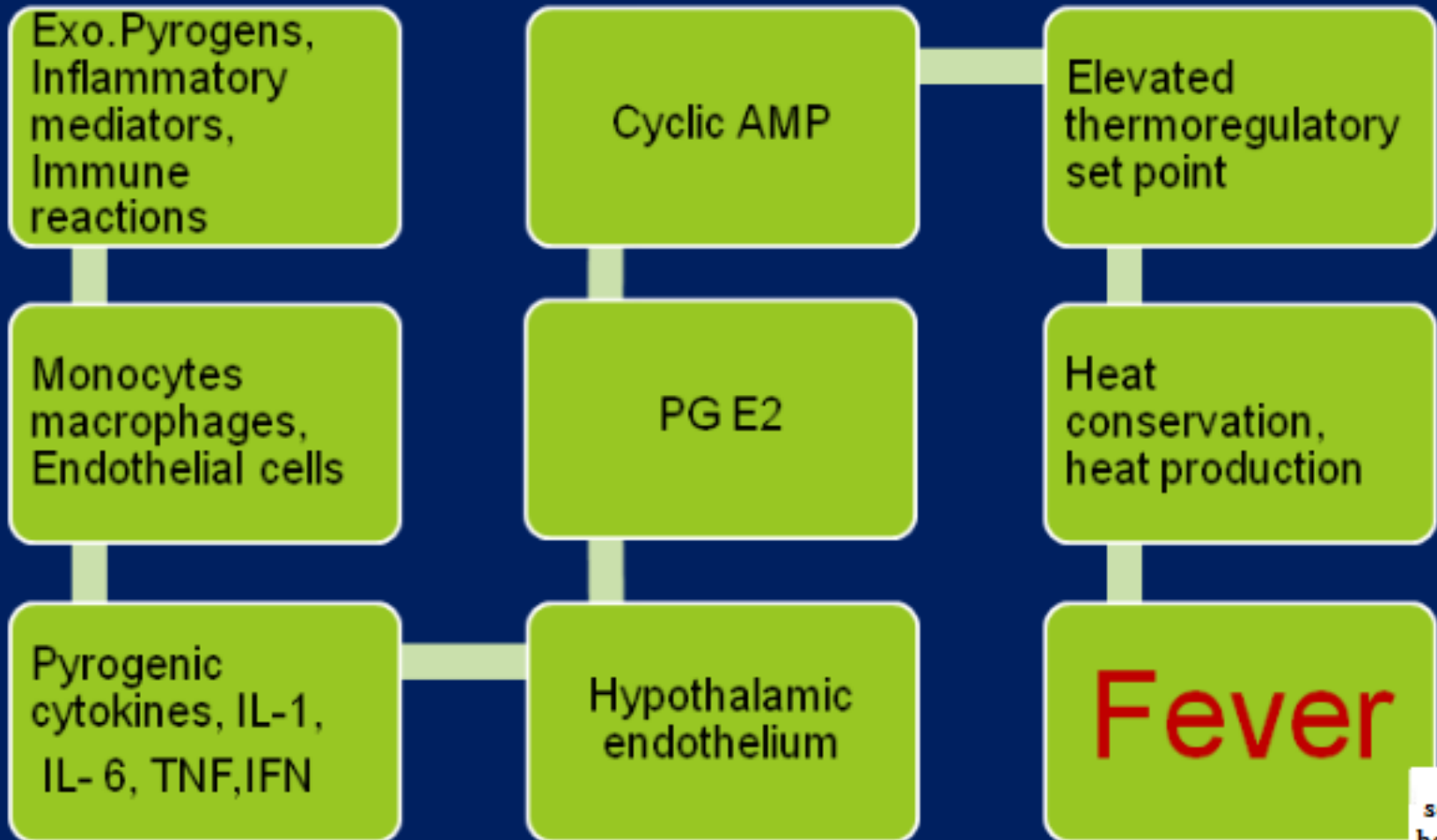
1. Increased heat production by

- Shivering of the muscles
- Increased metabolic activities (non-shivering) in the liver

2. Increased heat conservation

- **Cutaneous Vasoconstriction (raise temp. by 1-2°C):** Shunting blood from the periphery to the internal organs that decreases heat loss from the skin
- **Behavioural adjustments:** Due feeling of cold putting on more clothing or bedding raise body temperature by decreasing heat loss

Patho physiology of Fever



Hyper-pyrexia

Hyper-pyrexia: Extreme elevation core temperature greater than or equal to 41.5 °C (106.7 °F)

- It is a medical emergency
- May indicate a serious underlying condition or lead to problems including permanent brain damage, or death

Hyper-pyrexia

Cause of hyper-pyrexia

- Sepsis/infections: viral, bacterial
- Intracranial haemorrhage
- Neuroleptic malignant syndrome
- Drug overdose
- Serotonin syndrome
- Thyroid storm.

Difference between hyper pyrexia and hyperthermia

Hyperpyrexia	Hyperthermia
A fever of $>41.5^{\circ}\text{C}$ ($>106.7^{\circ}\text{F}$)	Uncontrolled increase in body temperature that exceeds the body's ability to lose heat.
The set point is above the normal	The setting of the hypothalamic thermoregulatory center is unchanged.
Fever is due to some pyrogens	Does not involve pyrogenic molecules.

Difference between hyper pyrexia and hyperthermia

Hyperpyrexia	Hyperthermia
Due to endogenous heat production only	Both exogenous heat exposure and endogenous heat production occur
No influence of exogenous factors	Exogenous heat exposure and endogenous heat production
Diagnosis: history	Diagnosis: history suggestive
Treatment: responds to antipyretics	Treatment :does not respond to antipyretics.

Approach to fever Patient

- History
- Physical examination
- Investigation
- Management

History

- Epidemiology
- Duration of fever
- Mode of onset
- Fever character
- Occupational history
- Personal history
- Travel history
- Animal bites
- Family history
- Immunisation
- H/O blood transfusion, drugs, surgery

Symptoms accompanied (accompaniments) by fever

- **Systemic symptoms**
 - Raised body temperature
 - Unpleasant symptoms: Headache, pleuritic pain, body ache, arthralgia
 - Feeling of cold or hot, weakness, shivering
- **Chills:** a symptoms complexes usually accompanied by cutaneous vasoconstriction, piloerection, teeth chattering and bed shaking.
- **Rigor:** violent muscle contractions to raise the core temperature
- **Sweating:**
- **Altered mental status, irritability**
- **Convulsions:** CNS infection, cerebral malaria, meningitis,
- **Herpes labialis:** Malaria,

Clinical types of fever

- Acute/fever of short duration
- Fever without localizing sign
- Fever with localizing sign
- Prolonged fever
- PUO
- Fever in injection drug users
- Fever in immune compromised host
- Neutropenic fever
- Post transplantation fever

Fever of short duration

- Duration of fever < 2 weeks
- **Common causes**
 - Infections
 - Thromboembolic disease
 - Gout
 - Drug allergy

Fever of short duration

- **Characteristic of short fever**
 - Abrupt onset
 - High rise of temperature
 - Respiratory symptoms
 - Prominent systemic symptoms: Severe malaise, muscle or joint pain photophobia, pain on movement of eyes, head ache
 - Nausea, vomiting or diarrhoea
 - Acute tender enlargement of lymph nodes or spleen
 - Meningeal signs with or without spinal fluid pleocytosis
 - Dysuria, urinary frequency, and flank pain

Prolonged fever

- Duration of fever >2 weeks
- Diagnosis remains obscure for weeks or months
- Needs skilful approach - careful history, repeated physical examination, carefully considered and staged use of laboratory examination and imaging techniques

Pyrexia/Fever of unknown origin (P/FUO)

Defined as:

- Temperature $>38.0^{\circ}\text{C}$ on multiple occasions for >3 weeks
- No diagnosis, despite initial investigation in hospital for 1 week, (has been relaxed to investigation over 3 days of inpatient care) or
- Three outpatient visits or
- One week of intensive ambulatory investigation

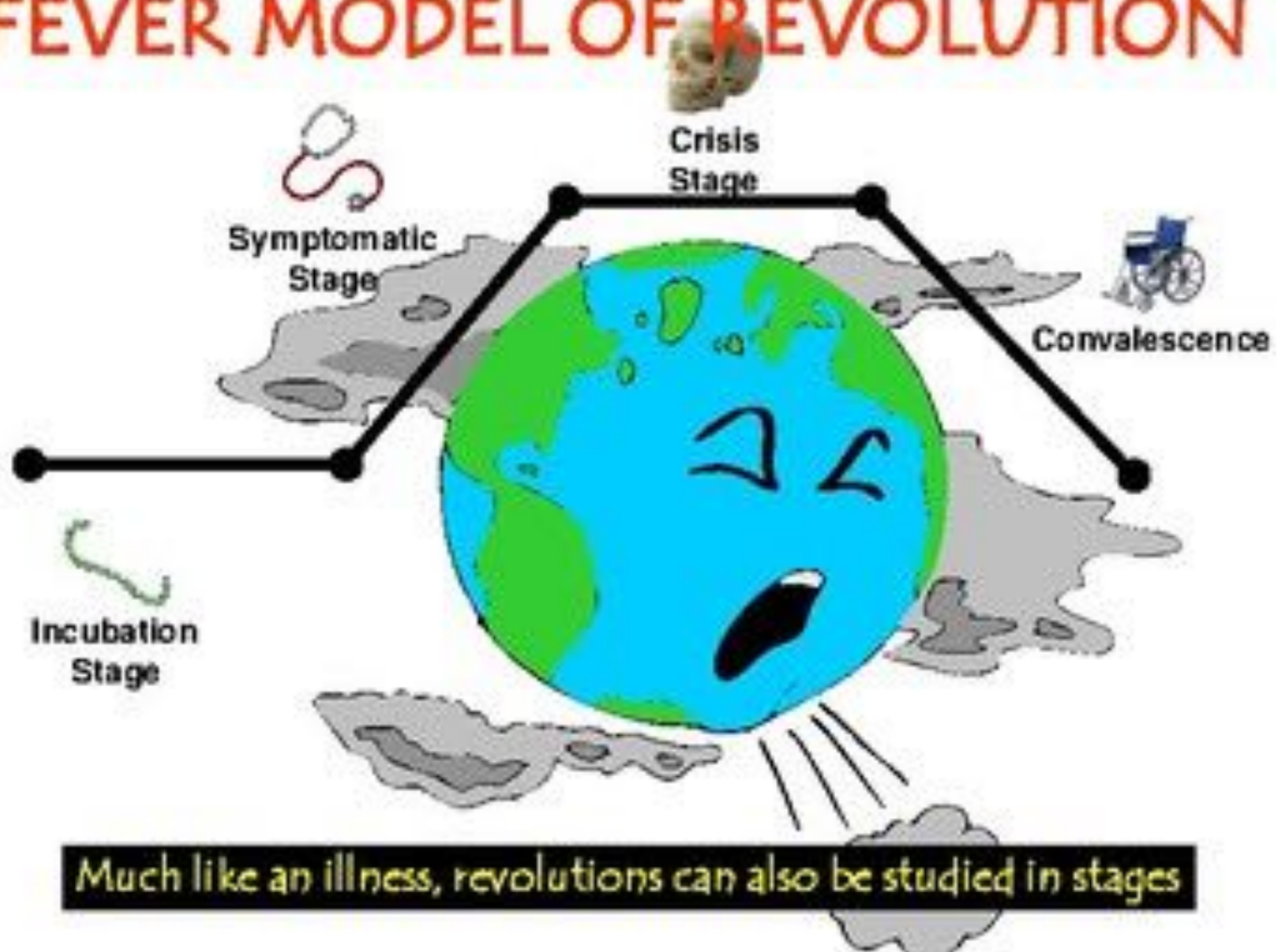
Pattern of fever

- Continuous/sustained fever
- Remittent fever
- Intermittent fever
 - Quotidian
 - Tertian
 - Quartan

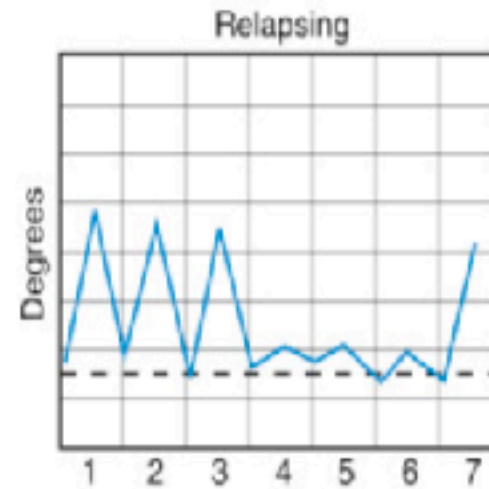
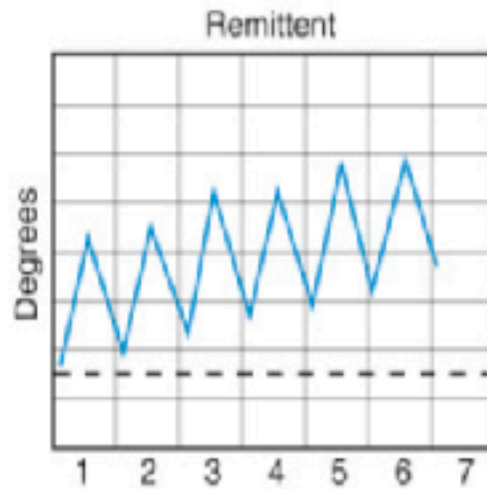
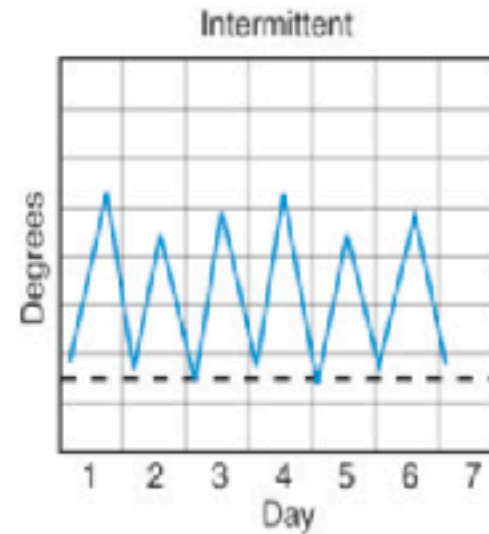
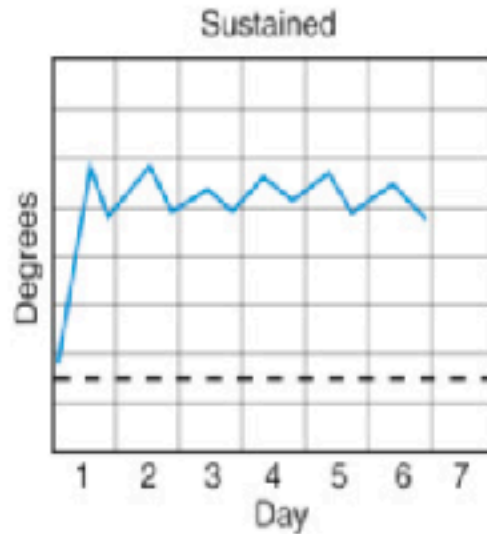
Pattern of fever

- **Continuous fever:** temperature remain above the base line throughout the day and fluctuates $< 1^{\circ}\text{C}$ in 24 hours e.g. lobar pneumonia, typhoid fever, UTI, typhus, brucellosis
- **Remittent fever:** Temperature remains above the base line and fluctuates $> 1^{\circ}\text{C}$ in 24 hours e.g. infective endocarditis.
- **Intermittent fever:** Fever persist for few hours in 24 hours and remain in the base line for rest of the time of the day. e.g. malaria, pyaemie, septicaemia. The periodicity may occurs in 24 hours (quotidian), 48 hours (tertian) and 72 hours (quartan)

FEVER MODEL OF REVOLUTION

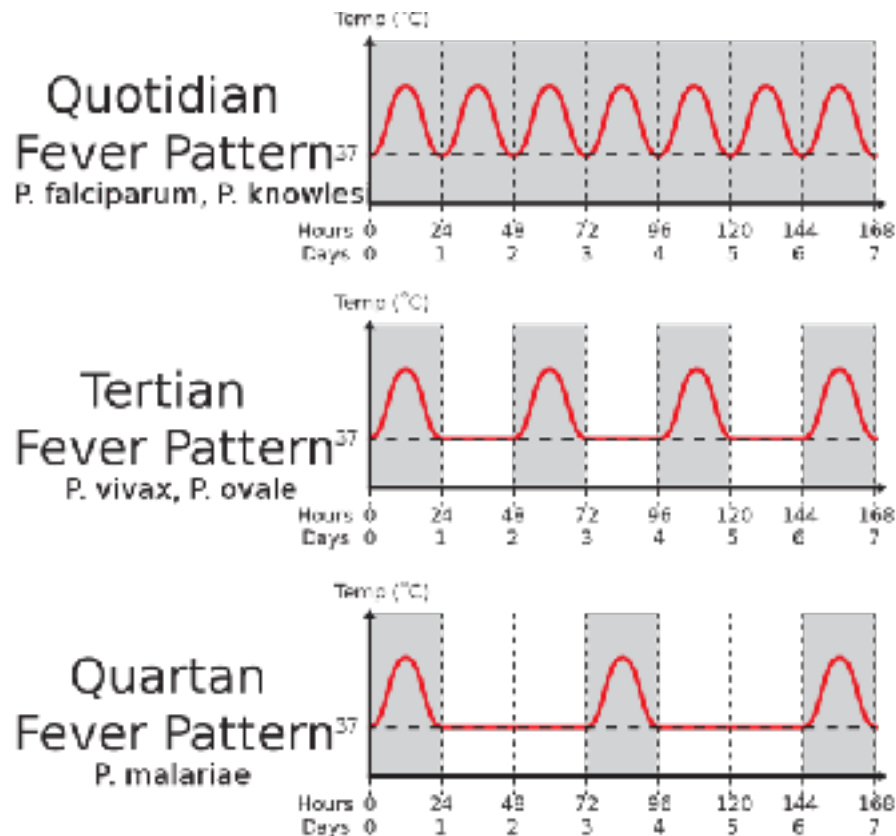


Pattern of fever



Pattern of fever

Intermittent fever

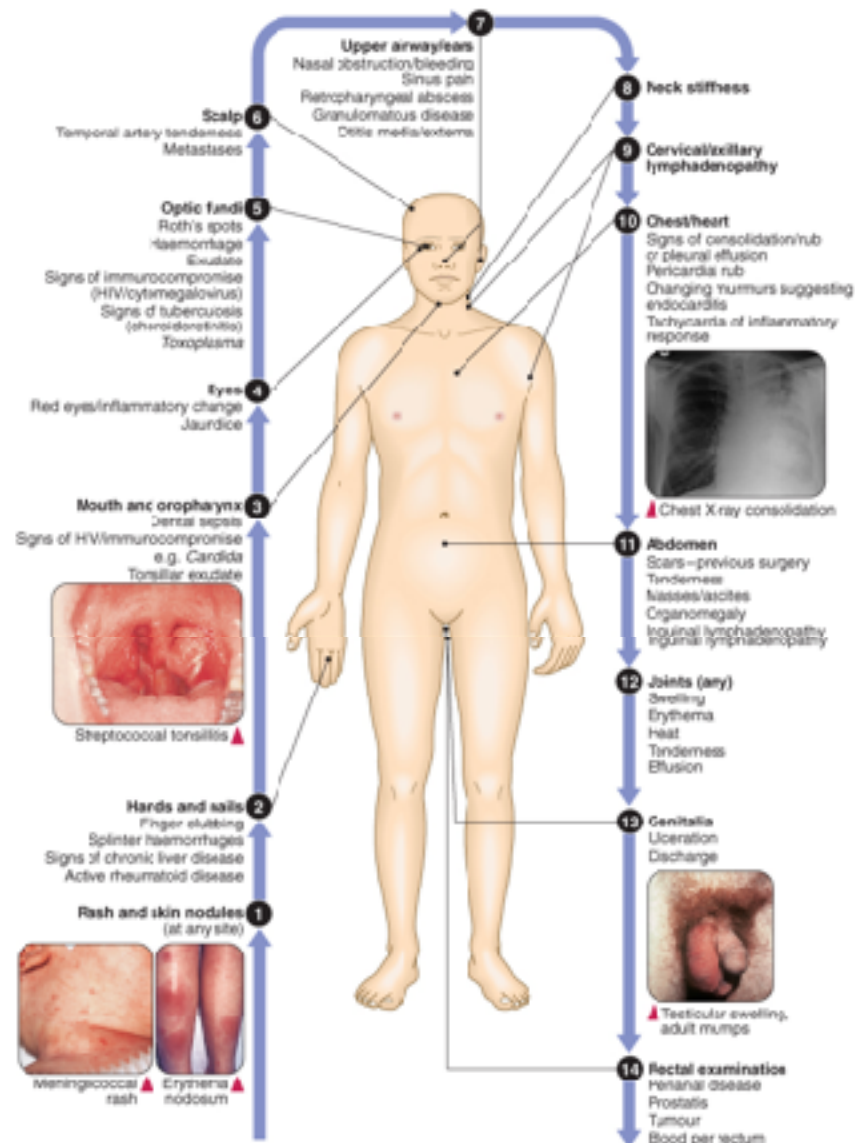


Pattern of fever

- Type of fall
 - Fall by Lysis
 - Fall by Crisis

Physical examination

- General examination
- Systemic examination
- Local or regional examination
- Relevant examination



Physical examination

Investigations

- The focus on investigation depends the findings of history and physical examinations. The investigations are
 - Clinical pathology
 - Bio-chemistry
 - Microbiology
 - Radiology
 - Immunology
 - Cytology/biopsy
 - Molecular
 - Drug trail

Investigation

- **Clinical pathology:** CBC, blood parasites, urinalysis, abnormal fluid examination, Bone marrow, stool examination
- **Bio-chemistry:** Electrolytes, glucose, BUN, creatinine, LFT, RFT, CPK, enzymes
- **Radiology & imaging:** Chest x-ray, CT, MRI, USG, echo
- **Microbiology:** Smears and cultures, throat, urethra, anus, cervix, vagina, urine, blood, abnormal fluid, CSF
- **Immunology:** Antigen, antibody, hypersensitivity sensitivity reaction
- **Molecular:** PCR, RT-PCR, Gene x-pert
- **Cytology/histopathology:** FNAC, Smear, swab, histopathology

Management

The decision to treat fever

- Most acute fevers are self limited infections
- Routine use of antipyretics are discouraged
- Fever may be absent or hypothermic in spite of sepsis
 - New born, elderly, CRF, steroid therapy, septic shock
- Temperature pulse dissociation
 - Typhoid, brucellosis, leptospirosis, drug induced fever, and factitious fever

Management of fever

- The objectives in treating fever are
 - To reduce the elevated hypothalamic set point
 - To facilitate heat loss
 - To reduces systemic symptoms
 - To prevent fever complication like convulsion
 - Fever with localising sign
 - Fever in immunocompromised patient

Management of fever

Pharmacological: Antipyretic

- **Acetaminophen:** preferred to all antipyretic
- **Aspirin:** effectively reduce fever but can affect platelets and GIT, In children, aspirin increases the risk of Reye's syndrome
- **NSAIDs:** Rapidly and potent less preferred for adverse effects
- **Steroid:** Most potent mask or aggravate the diseases

Non pharmacological measure

- Taped sponging, fanning, warping with wet blanket, shower etc

Management of fever

- **Hyper-pyrexia:** Taped sponging, antipyretics, cooling blankets, bathing, treatment of cause

Management of hyperthermia

- Physical cooling with sponging, fans, cooling blankets, ice baths,
- IV fluids, pharmacologic agents, gastric or peritoneal lavage with iced saline
- In extreme circumstances, hemodialysis or cardiopulmonary bypass with cooling of blood

Management of Hyperthermia

- Malignant hyperthermia, neuroleptic malignant syndrome, drug-induced hyperthermia hyperthermia of the serotonin syndrome and thyrotoxicosis: General anesthesia and dantrolene sodium, 1-2.5 mg/kg IV 6 h for at least 24-48 hour until oral dantrolene can be administered
- Procainamide for ventricular fibrillation

Management of hyperthermia

- The neuroleptic malignant syndrome may also be treated with bromocriptine, levodopa, amantadine, or nifedipine or by induction of muscle paralysis with curare and pancuronium
- Tricyclic antidepressant overdose may be treated with physostigmine