Exposure to

PHYSICAL HAZARDS

Extremes of Temperature

Prof. Ashraf Zaghloul

HOW A BODY RELEASES HEAT

1. Radiation: transfer of heat from a hotter object to a cooler object through space by radiant energy

2. Conduction: transfer of heat from molecule to molecule of adjacent objects

3. Convection: transfer of heat in liquids or gases in which molecules are free to move

4. Evaporation: heat loss involves the changing of a substance from its liquid state to its gaseous form

How does the human body regulate body temperature?

The body regulates body temperature by circulating blood near the surface of the skin, by exhaling warm, humidified air, and by evaporating sweat.

The body can survive only at a narrow range of core temperatures

Body temperature regulation is governed by:

- Central autonomic responses to core temperature changes to the hypothalamus.

- Central and peripheral responses to skin temperature changes which facilitate the loss or preservation of body heat.

Body temperature processes function best when ambient temperature is around (21°C -23°C) (70°F – 74°F)

Where we feel most comfortable

Acclimatization التأقلم

Acclimatization is the **beneficial physiological adaptations** that occur during repeated exposure **to a hot environment**.

Acclimatization requires 4- 6days

Acclimatization is accomplished by regular exposure to heated environment of increasing (intensity & duration).

The acclimatized person adjusts to heat by decreasing the blood flow to the skin, increase the quantity of sweat, diminish sweat salt content, increasing the plasma volume, cardiac output and stroke volume while the heart rate decreases also increase blood supply to muscles.

INFLUENCING FACTORS

1. Air temperature
2. Temperature of surrounding objects
3. Sun’s radiant heat
4. Relative humidity
5. Air movement
6. Amount and type of clothing worn
7. Heat produced by the body

Heat injury (in order of decreasing severity):

1. Heat stroke
2. Heat exhaustion
3. Heat cramps
4. Heat syncope
5. Skin disorders (heat rash, erythema, intertrigo and heat urticaria).

Workers at risk

Smelters, steel workers, glass blowers, farmers, fishermen, construction workers, military troops, athletes, pilgrims.






Heat Injury

Prof. Ashraf Zaghloul

Predisposing Factors

- Overweight and fatigue
- Heavy meals and hot food
- Alcohol and drugs (Drugs that inhibit sweating are atropine, antihistamines, some tranquilizers, cold medicine and some antidiarrheal medicines)
- Fevers
- Tight clothing

HEAT SYNCOPE اغماء الحرارة

- ✓ <u>It is a potential problem for workers who must stand for long periods in hot environment causing sudden unconsciousness.</u>
- ✓ Episodes are observed in absence of substantial exertion in unacclimatized person to heat.
- ✓ It results from cutaneous vasodilatation with consequent systemic & cerebral hypotension (ABP < 100 mmHg).
- ✓ Prior to loss of consciousness pulse rate is elevated but core temperature is not, skin is cool &moist.
- ✓ Treatment consists of recumbence, cooling and fluid by mouth.

Heat Syncope "Fainting"

***Mechanism:**

Increase body temperature

↓

Vasodilatation

↓

Decreases blood pressure

↓

Decrease blood flow to brain

↓

Syncope

***Treatment:**

-Remove the patient from hot environment.

-Heat must be lowered.

-Raise the patient`s feet to maintain blood flow to the brain.

-Supply fluids when patient regain his consciousness.

Heat Cramps

Heat Cramps تشنجات حرارية

- Excessive salt loss
- Painful cramps of muscles usually in arms, legs and stomach area
- Heat exhaustion may be present
- Body temperature may be normal
- Avoided by proper nutrition and hydration

Heat Exhaustion

Prof. Ashraf Zaghloul

Heat Exhaustion الإنهاك الحراري

- **Excessive salt and water loss**

- **Skin is cool and moist**; pulse is rapid and blood pressure may be low

- Other symptoms are profuse sweating, headaches, tingling in hands and feet, paleness, difficulty breathing, irregular heart beat, **loss of appetite, nausea and vomiting**

Heat Exhaustion الإنهاك الحراري

- Oral temperature may be lower than normal if the person is hyperventilating

- Trembling, weakness, lack of coordination and a slight clouding of senses to momentary loss of consciousness complete the classic picture

- Avoided by proper work/rest cycles and **good hydration**

Heat Stroke

Prof. Ashraf Zaghloul

HEAT STROKE ضربة شمس

- **A medical emergency and death rate is high**
- **The body's heat regulatory mechanism stops functioning and the main avenue of heat loss is blocked**
- Early signs are headache, dizziness, delirium, weakness, nausea, vomiting and excessive warmth
- Skin is usually hot, red and dry
- Body temperature may be as high as **41 – 42°C**

HEAT STROKE ضربة شمس

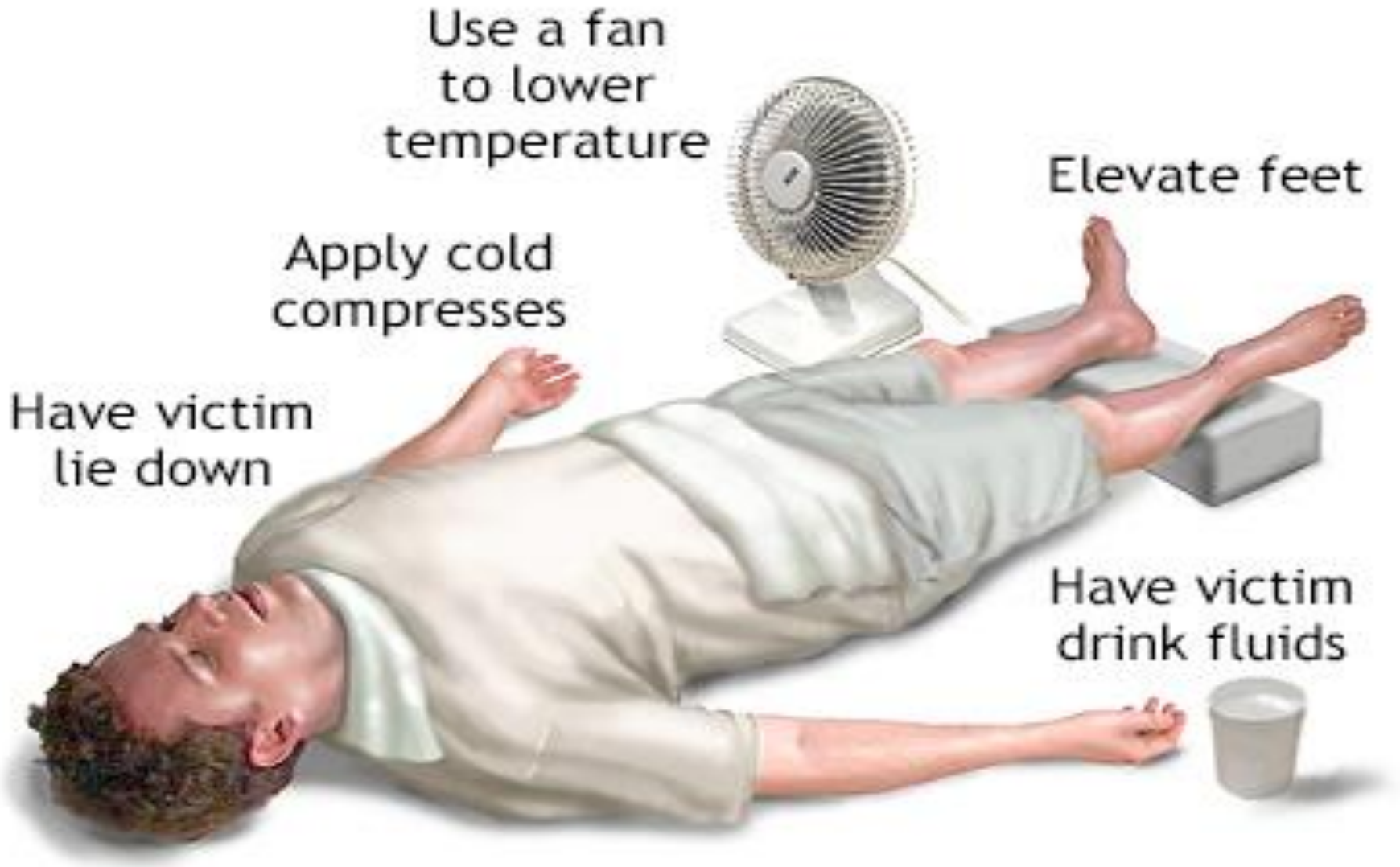
- The casualty may go through heat cramps or heat exhaustion; a sudden collapse and loss of consciousness followed by coma and **convulsions** may occur

- Sweating may or may not be present

- Avoided by proper work/rest cycles and full hydration

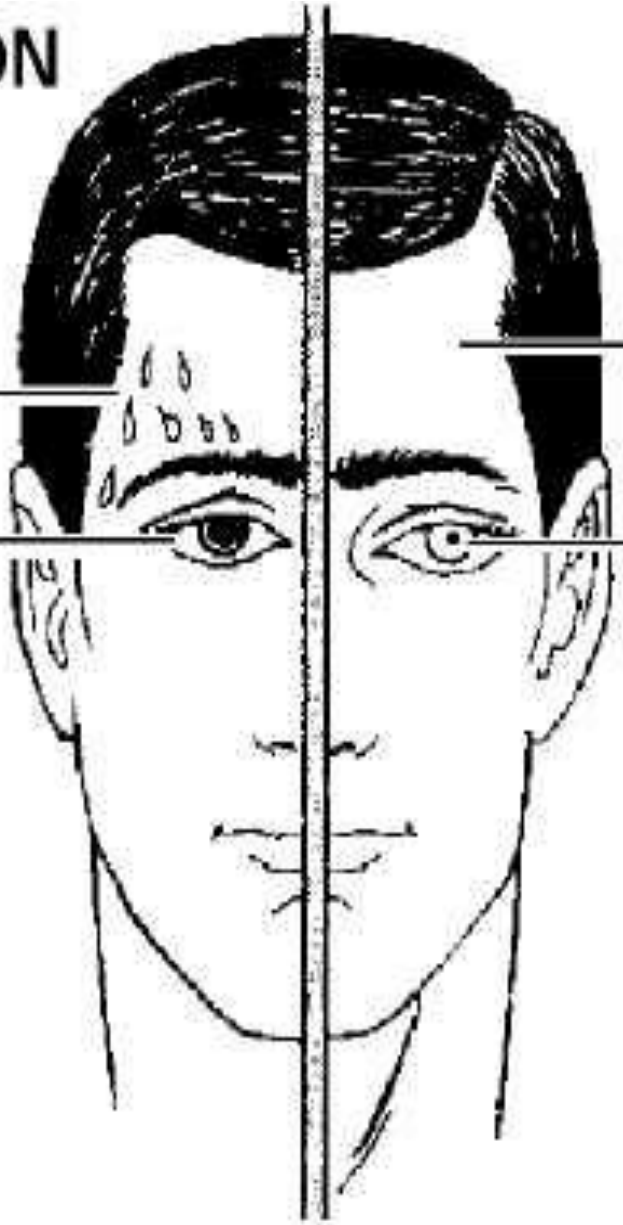
First aid for heat cramps and exhaustion

- Move the victim to a **shady area** and loosen clothing if possible
- Slowly give large amounts of cool water
- **Pour water** on victim and fan
- **Elevate legs** for exhaustion
- **Watch the victim**, if possible release from the strenuous activity
- Get medical help if symptoms continue


Use a fan
to lower
temperature
Elevate feet
Apply cold
compresses
Have victim
lie down
Have victim
drink fluids

HEAT EXHAUSTION

1. MOIST & CLAMMY SKIN
2. PUPILS DILATED
3. NORMAL OR SUBNORMAL TEMPERATURE



HEAT STROKE

1. DRY HOT SKIN
2. PUPILS CONSTRICTED
3. VERY HIGH BODY TEMPERATURE

First aid for heat stroke

- Lower the subject's body temperature ASAP
- Elevate subject's legs
- Have subject drink water if possible
- **GET MEDICAL HELP**

Preventing Heat Injuries

- Replace water loss (provide adequate water at all times).
- Maintain acclimatization
  - Begin acclimatization with first exposure
  - Continue with two 50 minutes periods daily
  - Limit intensity and time of exposure for those not acclimatized
  - Acclimatization can be lost if remove from the hot environment for 1 month

Preventing Heat Injuries

- **Establish a good work/rest schedule**
  - Work in cooler hours
  - Provide comfortable working conditions
  - Avoid working in direct sunlight
  - Slowly increase exposure to those becoming acclimatized
  - Use proper clothing

Frostbite

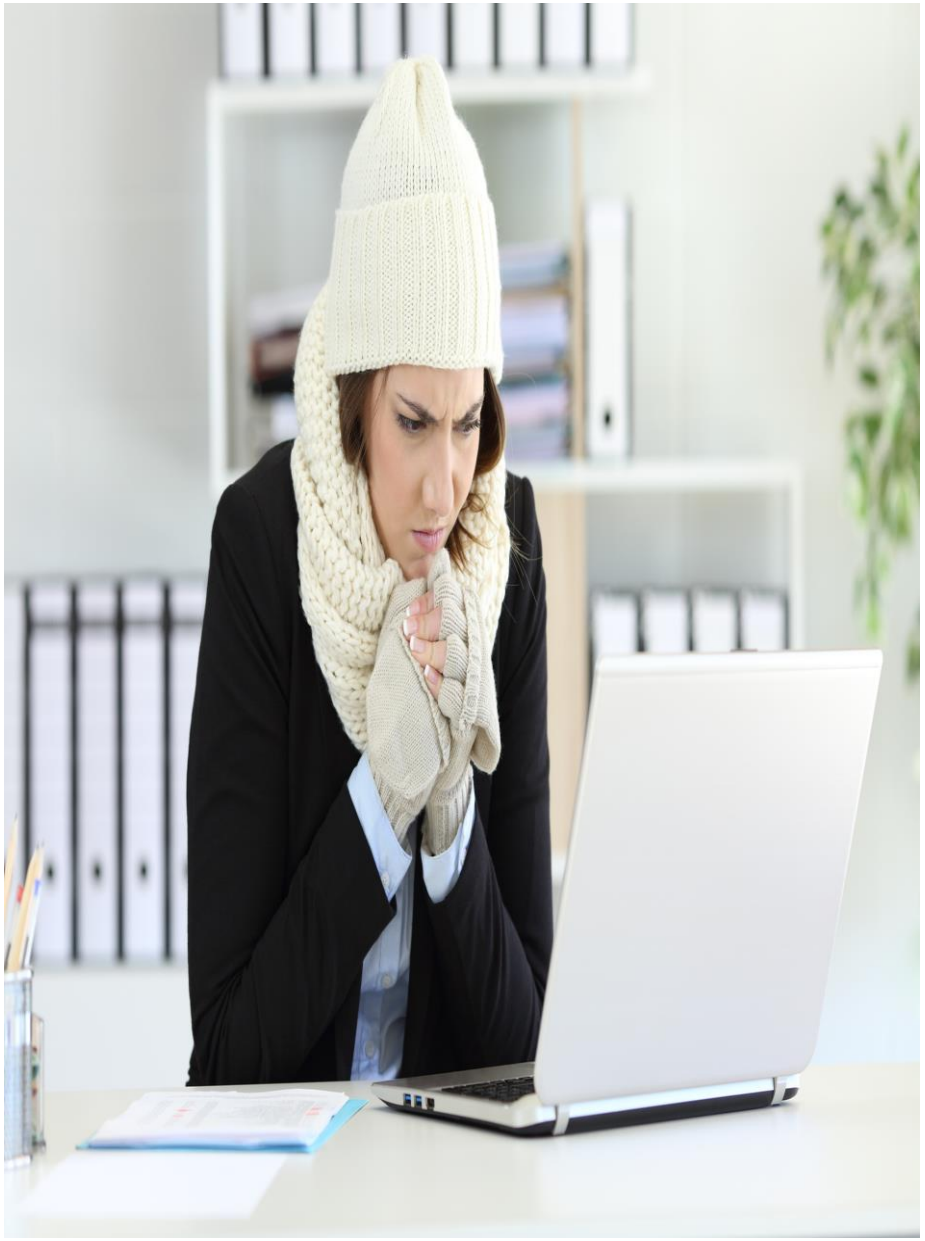
Frostbite

Frostbite is an injury caused by freezing of the skin and underlying tissues. In the earliest stage of frostbite, known as frostnip, there is no permanent damage to skin.

Symptoms include cold skin and a prickling feeling, followed by numbness and inflamed or discolored skin.

Frostbite

- Causes a loss of feeling and color in the affected areas. It most often affects the nose, ears, cheeks, chin, fingers, or toes.
- Frostbite can permanently damage body tissues, and severe cases can lead to amputation.
- In extremely cold temperatures, the risk of frostbite is increased in workers with reduced blood circulation and among workers who are not dressed properly.



Symptoms

Symptoms of frostbite include:

- Reduced blood flow to hands and feet (fingers or toes can freeze)
- Numbness
- Tingling or stinging
- Aching
- Bluish or pail, waxy skin

First Aid

Workers suffering from frostbite should:

- Get into a warm room as soon as possible.
- Unless absolutely necessary, **do not walk on frostbitten feet or toes,** this increases the damage.
- Immerse the affected area in **warm**-not hot-water (the temperature should be comfortable to the touch for unaffected parts of the body).

First Aid

- Warm the affected area using body heat; for example, the heat of an armpit can be used to warm frostbitten fingers.

- Do not rub or massage the frostbitten area; doing so may cause more damage.

- Do not use a heating pad, heat lamp, or the heat of a stove, fireplace, or radiator for warming. Affected areas are numb and can be easily burned.

Light and Lighting

Prof. Ashraf Zaghloul

Exposure to

PHYSICAL HAZARDS

Light and Lighting

Prof. Ashraf Zaghloul

Light and lighting

Luminous intensity شدة الإضاءة

Is the term applied to the luminous flux emitted per solid angle and is measured in **candela (Cd).**

Lighting and Health

In striving for optimum lighting conditions it is essential to consider the **intensity and colour spectrum** of the light sources used.

Incorrect selection may lead to adverse health and/or psychological effects.

The selection of the appropriate illuminance for given visual tasks is vitally important.

Lighting and Health

- Too much illuminance can lead to the onset of **glare**

- Too little illuminance can put a **strain on the eyes**. In some cases the latter causes the individual to **adopt uncomfortable working postures which may lead to musculoskeletal problems.**

IMPORTANT

Poor lighting increases risk of fatigue and accidents reduces productivity and increases workers dissatisfaction, which may contribute to worker absenteeism.

Specific Health Risks

These include, but are not limited to:

- **Infrared and ultraviolet (UV) radiation**: tungsten halogen (desk top lamps) and other high powered lamps e.g. those used in broadcasting studios may emit high levels of UV radiation and cause harm to skin and eyes.

These lamps should be fitted with a safety shield or UV filter.







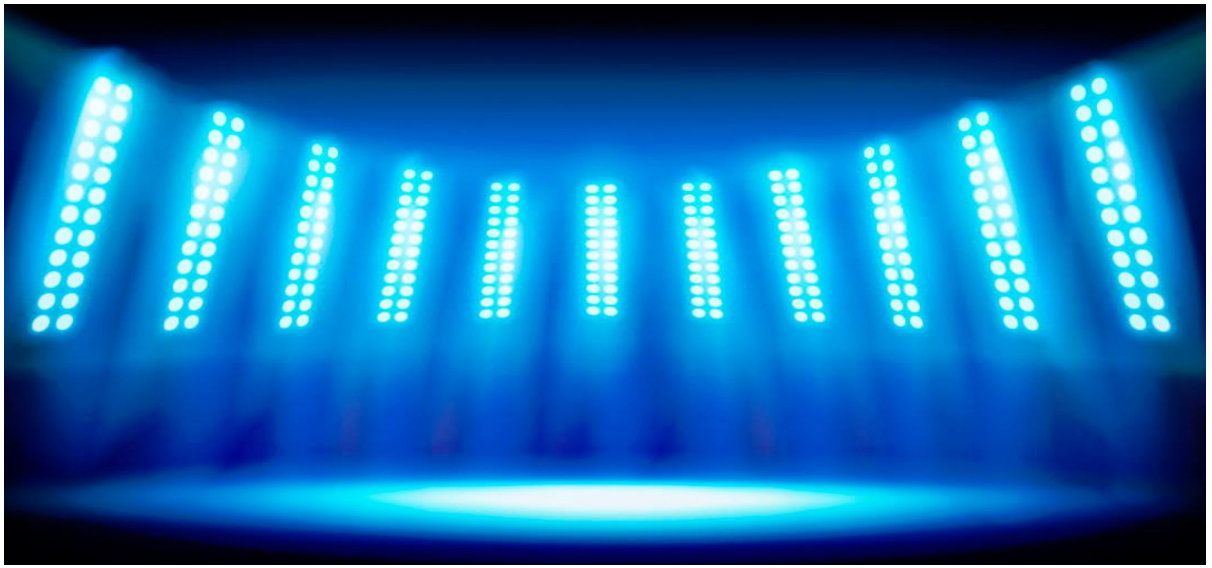

SPORTS
SPORTS
SPORTS

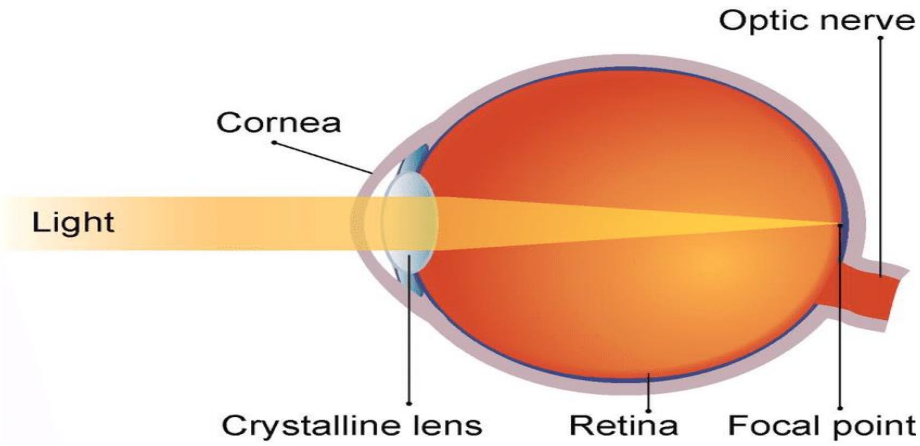

Blue light hazard (photo retinitis)

This is photochemical damage from exposure to medium to intense strength visible radiation for more than 10 seconds.

Blue light hazard is defined as the potential for a photochemical-induced retinal injury from radiation between 400 and 500 nanometer (nm).

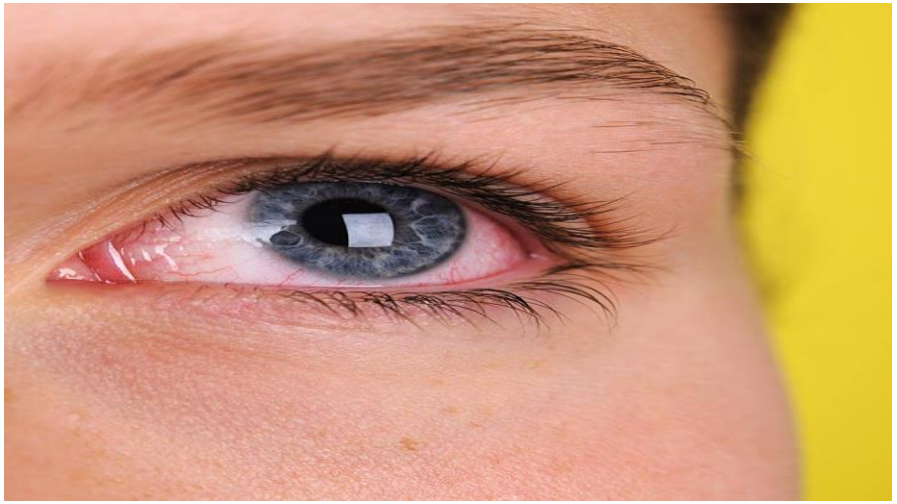
The damage is irreversible and can lead to blindness




Optic nerve
Cornea
Light
Crystalline lens
Retina
Focal point

Photokeratosis

A **tender eye condition** typically following exposure of insufficiently protected eyes to the ultraviolet rays emitted by either natural or artificial sources e.g. welder's arc or some artificial light sources.



Unwanted effects created by lamps and lighting

Glare الوهج

Occurs when one part of the visual field is much brighter than others.

There are two major types of glare:

- *Disability glare* where the individual is disabled from carrying out a given visual task

- *Discomfort glare* where the individual is not disabled from carrying out a given visual task, but where he/she will experience **discomfort**, which may be delayed in manifestation.

- **Veiling reflections انعكاس حاجب**

Is the term applied to the scenario where typically out of focus reflections of light sources are viewed on specular surfaces (typically display screen equipment).

This throws a veil of light over the screen making reading of text either difficult or impossible.

Veiling reflections is a form of disability glare

- **Flicker** رف، رمش

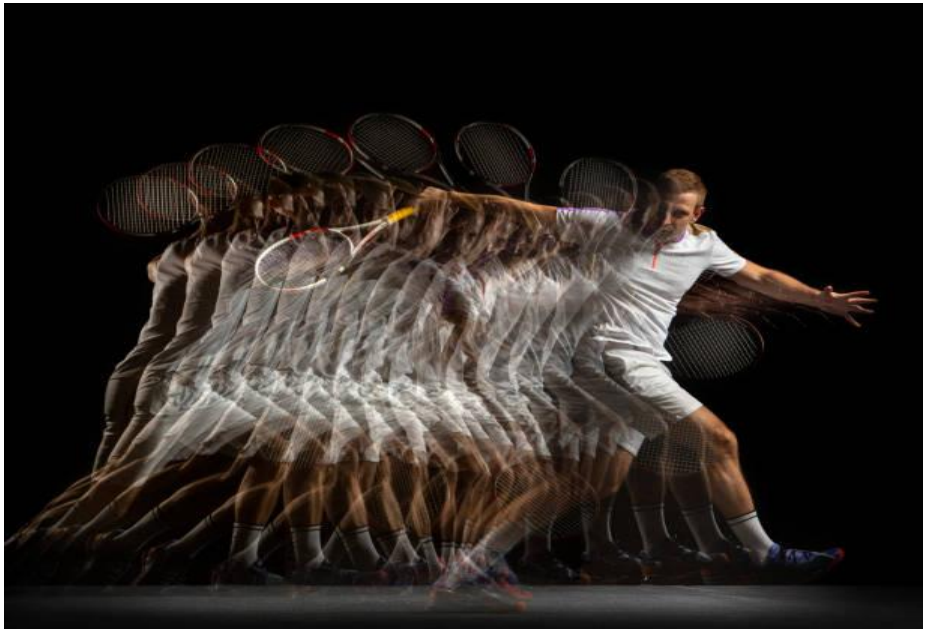
Is effectively light modulations at frequencies detectable by the human visual system. This can lead to both discomfort and fatigue and may provoke seizures in photosensitive individuals if the flicker frequency is typical 5–30Hz

- **Stroboscopic effects on rotating machines:**

ذو اختلال دوراني

This is the scenario where rotating elements of machinery appear to be stationary or moving in a different manner (possibly in the reverse direction).

It is caused by a combination of the rate of oscillations in light output illuminating the rotating element and the rate at which the human visual system can detect movement.




ROXBOT

Assessing lighting in the workplace

Workplace lighting should meet the following criteria:

- **Provides suitable and sufficient illuminance** on the work piece
- **Provides suitable and sufficient discrimination on the surface colours of objects** in the working area
- **Prevents the onset of glare** (e.g. disability glare)
- **Avoids flicker** and/or stroboscopic effects
- **Avoids** the effects of **veiling reflections**

Assessing lighting in the workplace

- Provides sufficient contrast between work piece and background

- Prevents excessive variation in illuminance and luminance within the vicinity of the working areas. Optimally, the ratio of luminance values (task: near surround: far surround) should be 10:3:1.

- Takes into account the requirements of workers with disabilities.

- Is located so that access to luminaires and other lighting equipment does not pose a risk to maintenance personnel

- **Incorporates appropriate emergency lighting**.