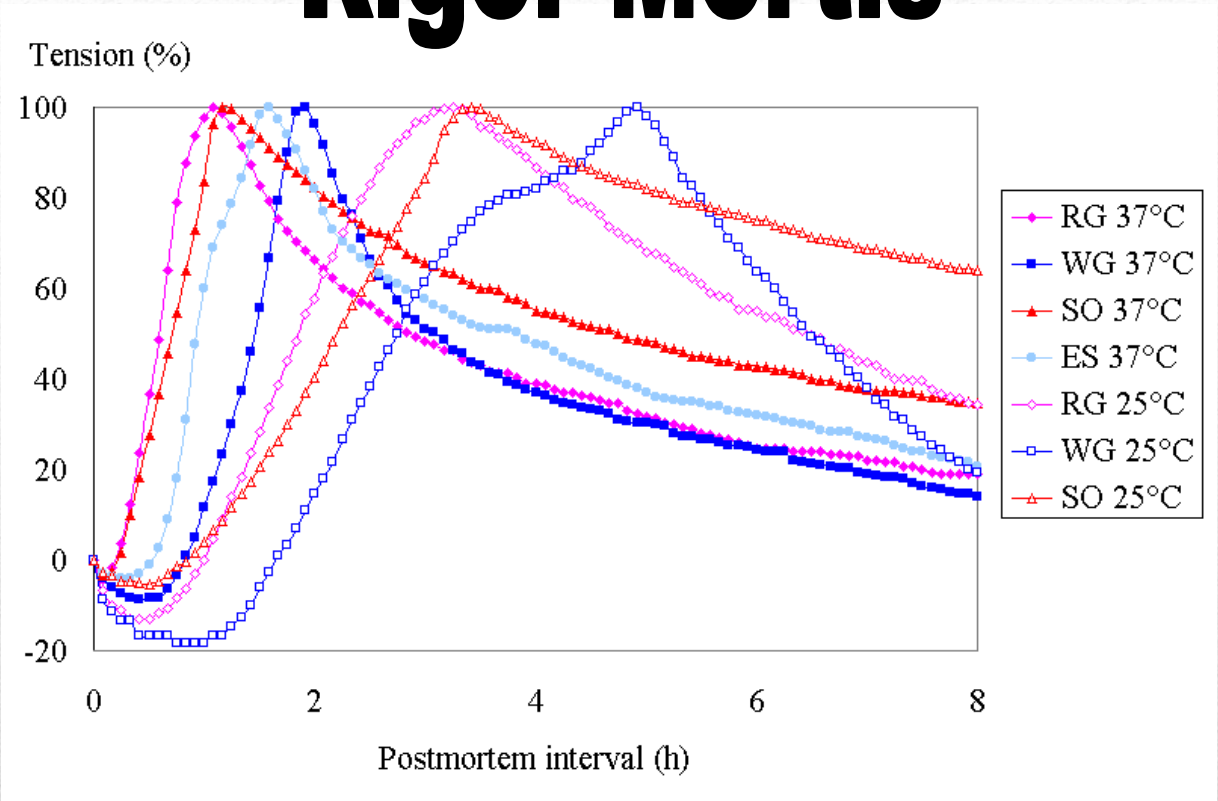
POST MORTEM INTERVAL

(TIME OF DEATH)

http://library.thinkquest.org/04oct/00206/text_index.htm
(The Autopsy)

Rigor Mortis

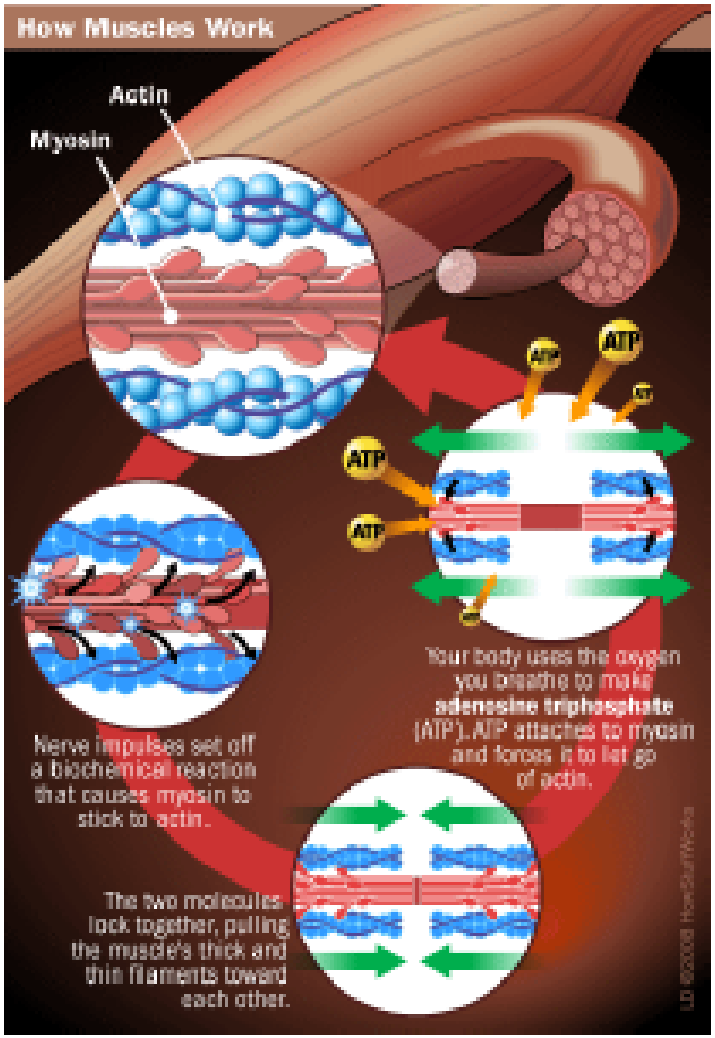


Rigor Mortis

- Chemical change in the muscles after death, causing the limbs of the corpse to become stiff and difficult to move or manipulate.
  - Onset: 3-12 hours
  - Disappears after 72 hours in humans (but WHY?!)

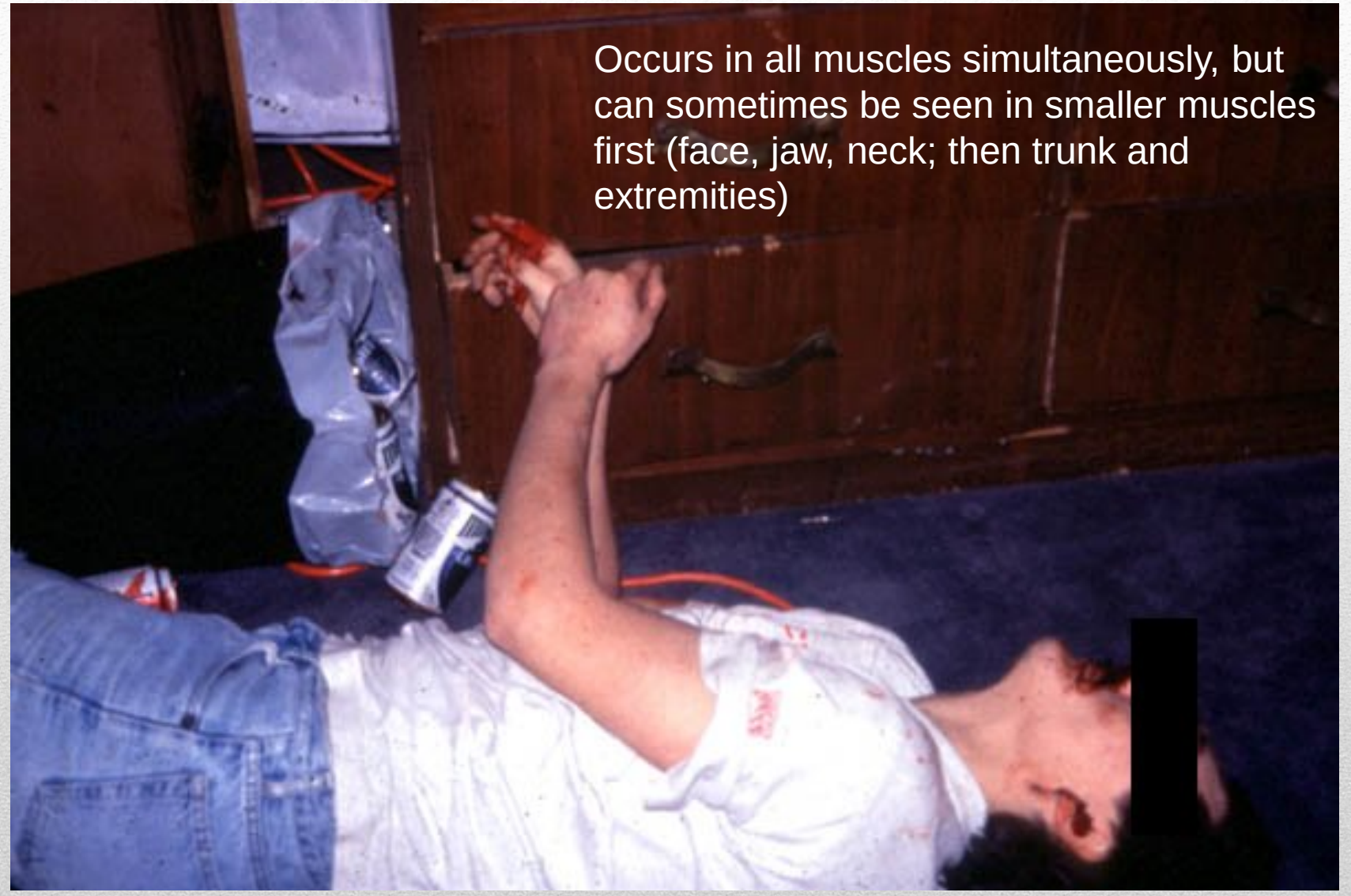
- TEMPERATURE can have an effect!!

Rigor Mortis



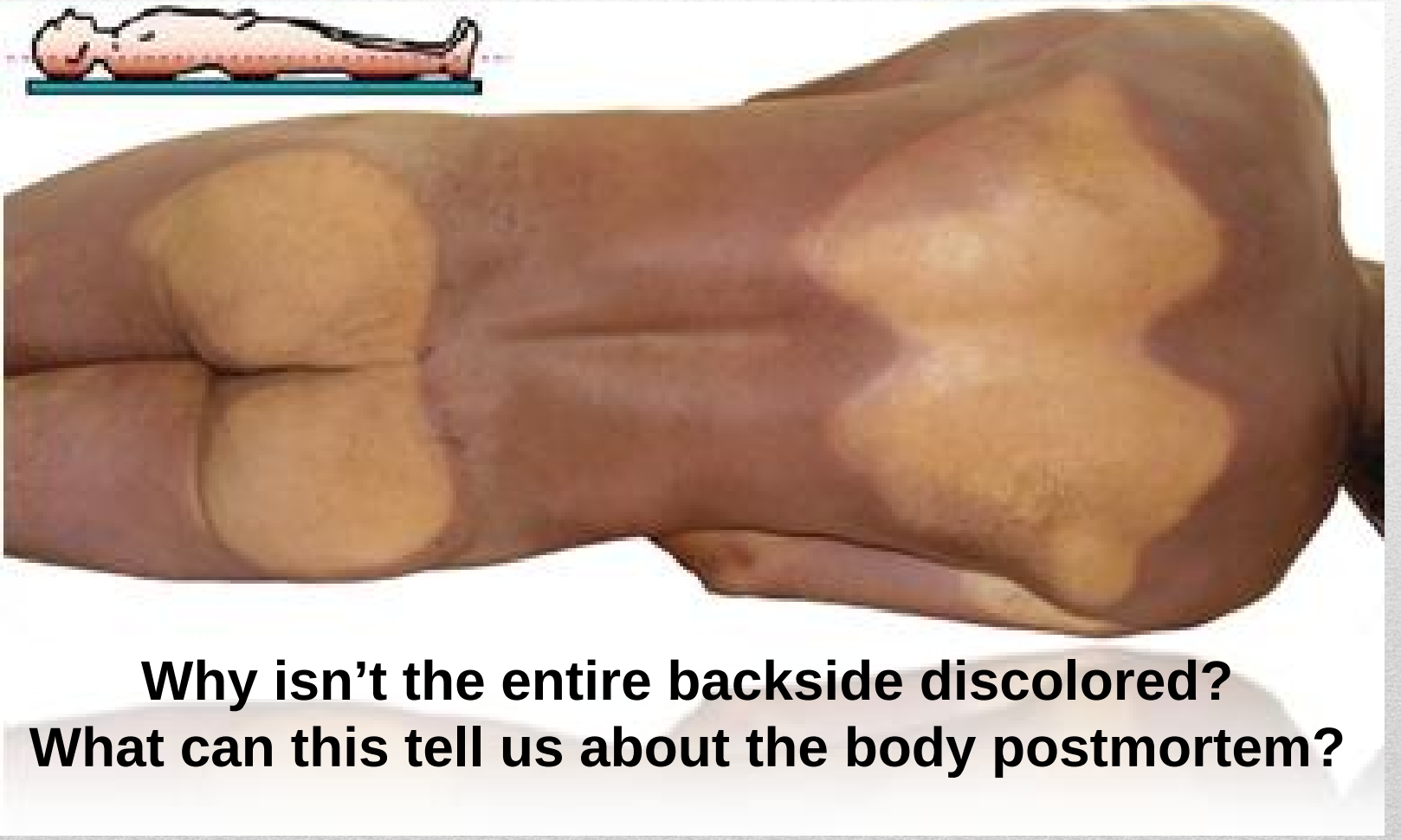
- Muscles contract when myosin and actin stick together. ATP is needed to detach the two. Without ATP (in death) they cannot separate and the muscles will stay locked in a constant state of contraction!

Rigor Mortis



Livor Mortis

What might be the cause of the discoloration (darker parts) of the skin in Livor Mortis?



Why isn’t the entire backside discolored?
What can this tell us about the body postmortem?

Livor Mortis

- **Livor mortis – (postmortem lividity/hypostasis) the settling of blood to the dependent (lowest) parts of the body.**

- **Livor begins at or very soon after death (30min-2hrs) since it is a function of cardiac activity. However, stasis can occur to some extent in shock and some degree can be present even while the person is technically alive.**

- The color of the dependent part will be governed by skin pigmentation and any additional compounds which may be present within the blood (i.e. carbon monoxide, etc.).

- **The areas where the blood has settled will generally be dark blue or purple in color.**

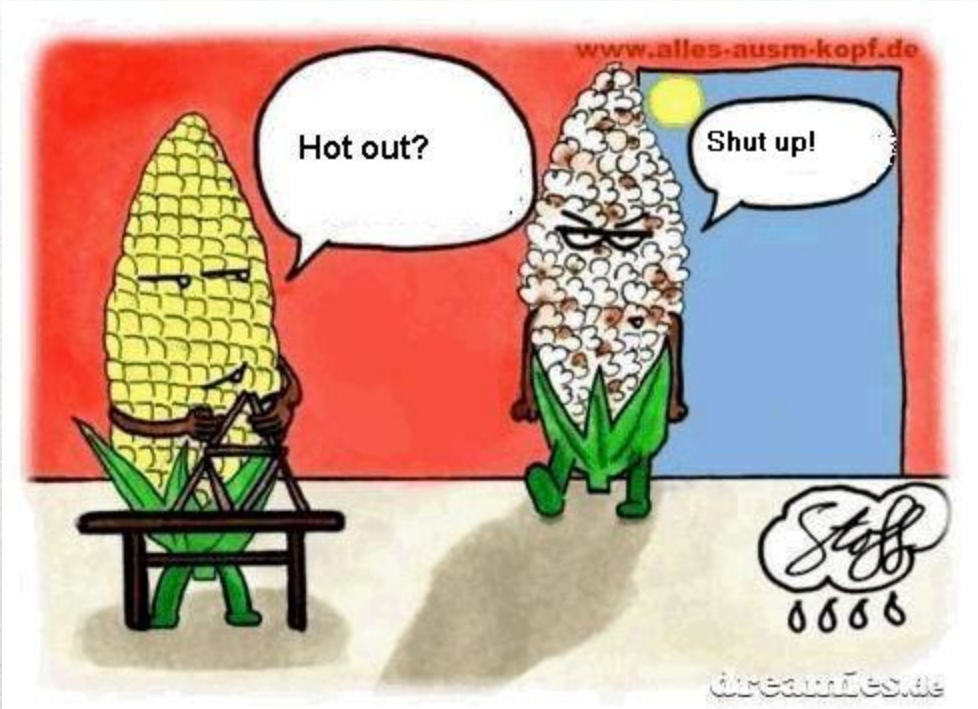
Livor Mortis

What can you tell about the condition of the body based on the pattern of lividity?

- **What assumptions can be made about the victim based on lividity?**
- **If this victim was found upright in a chair, what else can be assumed?**

Algor Mortis

- Algor mortis refers to *cooling of the body* postmortem.



Algor Mortis

- Postmortem body temperature (T_{PM}) declines progressively until it reaches the ambient temperature (T_A).
- Metabolism generates heat (regulated to a **narrow range**)
- The body cools at a uniform rate, thus the rate of T_{PM} decrease can be used to accurately determine the time of death (TOD).
- HOWEVER…body temperature is a **narrow range, not a fixed temperature**!
- Temperature factors (maintain/raise T_{PM}): activity, illness, decomposition, infection and absorption of heat
- The body cools by
  - radiation (transfer of heat to the surrounding air by infrared rays)
  - convection (transfer of heat through moving air currents)
  - conduction (transfer of heat by direct contact with another object).

- The **Glaister equation** is one formula used for determining the approximate time period since death based on body temperature:

$$\frac{98.4^{o}F - \text{measured rectal temperature}(^{o}F)}{1.5} = \text{approximate hours since death}$$

Example: Rectal Temperature is 88.4 deg. 98.4-88.4 = 10 degrees x 1.5 hours = 15 hours PMI.

Algor Mortis

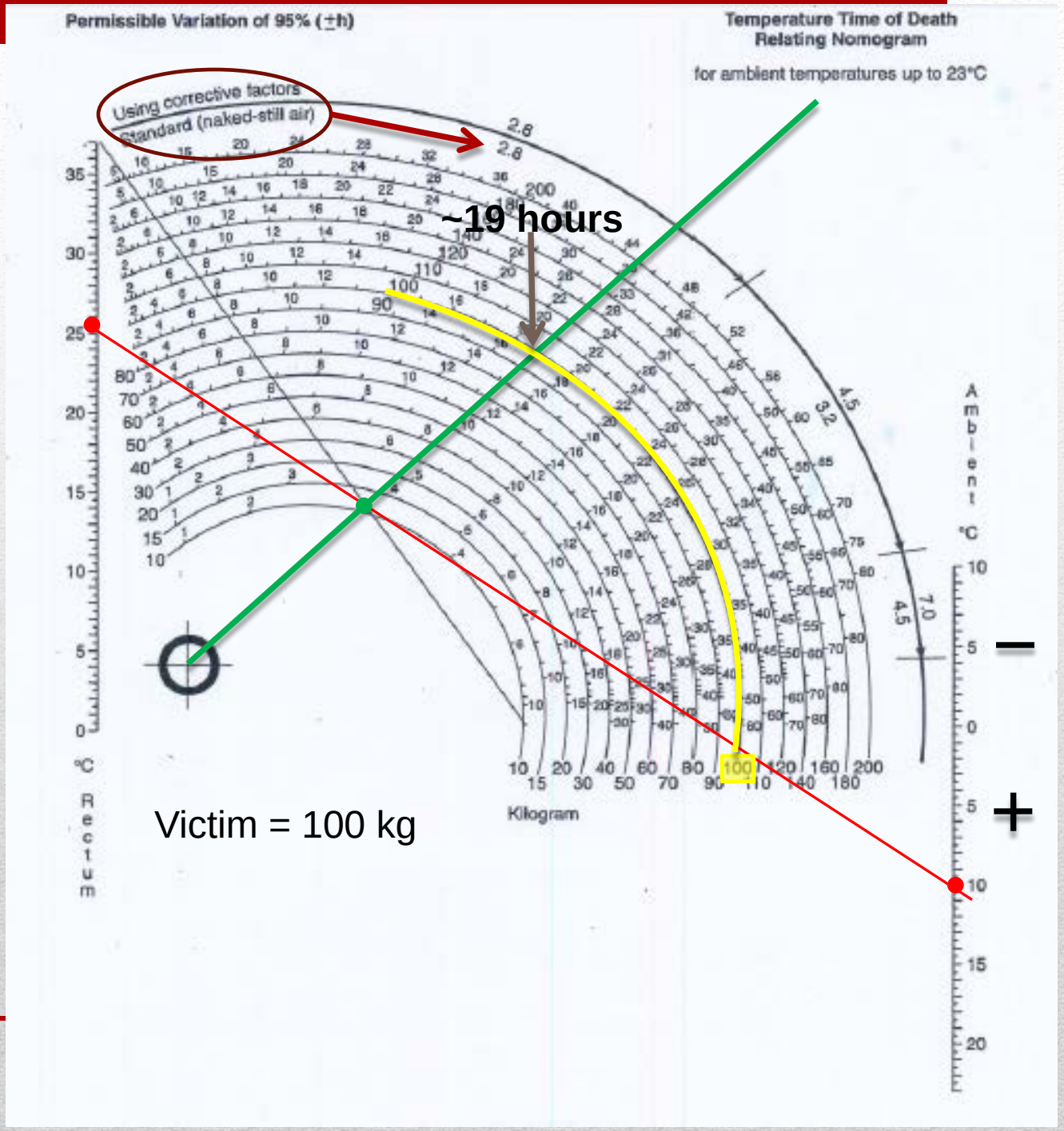
- **In average environmental conditions/temperatures, a few simple rules of thumb can be helpful:**

Bernard Knight's Formula

Body Condition	PMI
Warm and flaccid	< 3 hours
Warm and stiff	3-8 hours
Cold and stiff	8-36 hours
Cold and flaccid	> 36 hours

STANDARD NOMOGRAM

1. Rectal Temperature (C)
2. Ambient Temperature (C)
3. Draw line connecting
4. Draw 2nd line from crosshairs through intersection
5. Mass (in kg)
6. Use 2nd crosshairs line to find TOD on the appropriate mass line
7. Apply variation
8. Count backwards from discovery to death



Many factors may influence the **rate of heat loss**. Careful consideration of the scene, clothing, victim size, activity and physical factors must be considered in interpreting cooling rate.

USING CORRECTIVE FACTORS:

Take the body mass in kg and multiply by the correction factor to get the corrected body mass due to external conditions:

Mass (kg) = mass of body
CF = correction factor
$Mass_c$ = corrected mass

Mass (kg) x CF = $Mass_c$

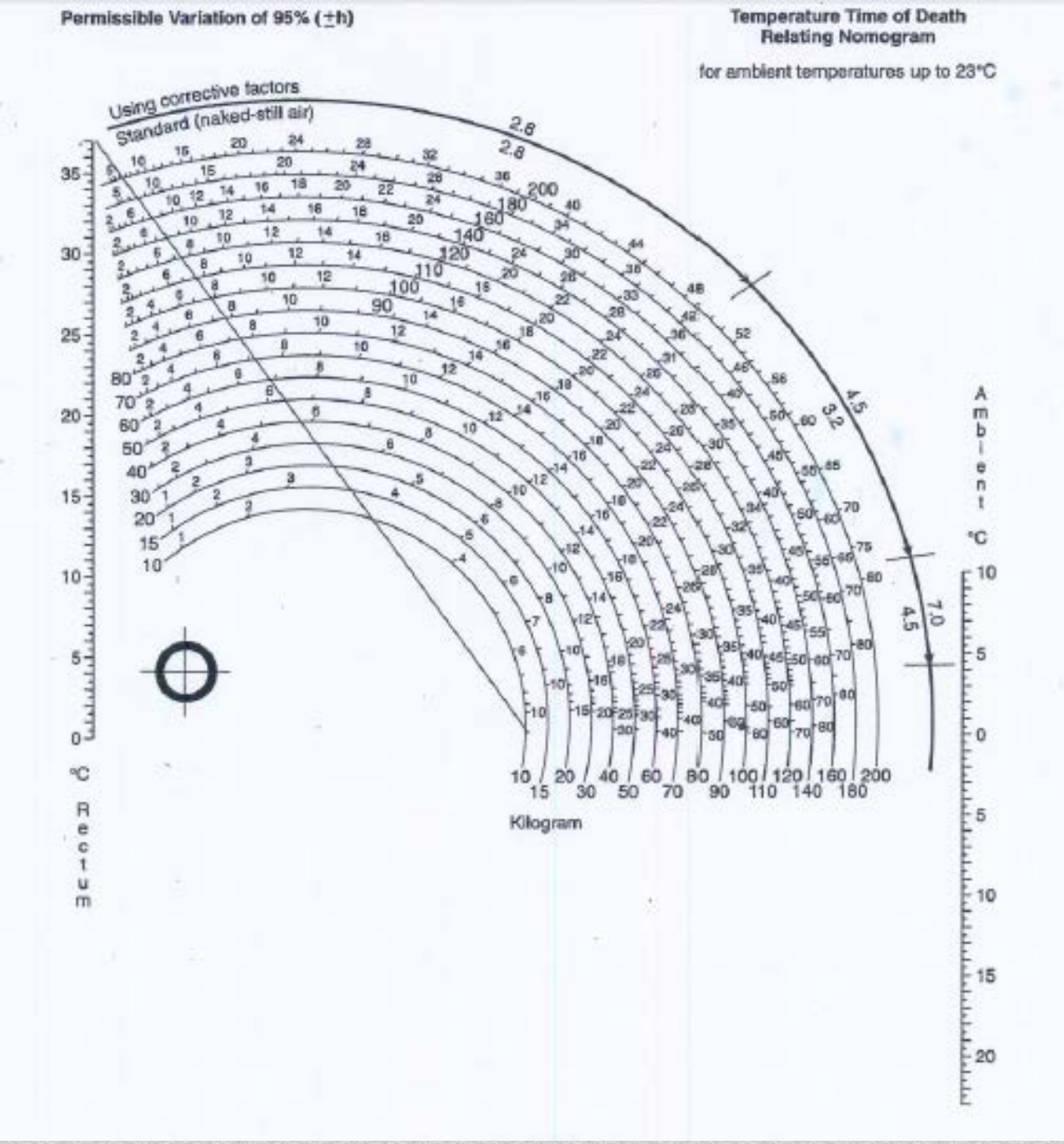
TABLE 2.1 Correction Factors for Body Weight in Estimating Time of Death

Wet Clothing or Wet Body Surface	Condition of Air	Condition of Water	Correction Factor
Naked	—	Flowing	0.35
Naked	—	Still	0.5
Naked	Moving	—	0.7
One or two thin layers	Moving	—	0.7

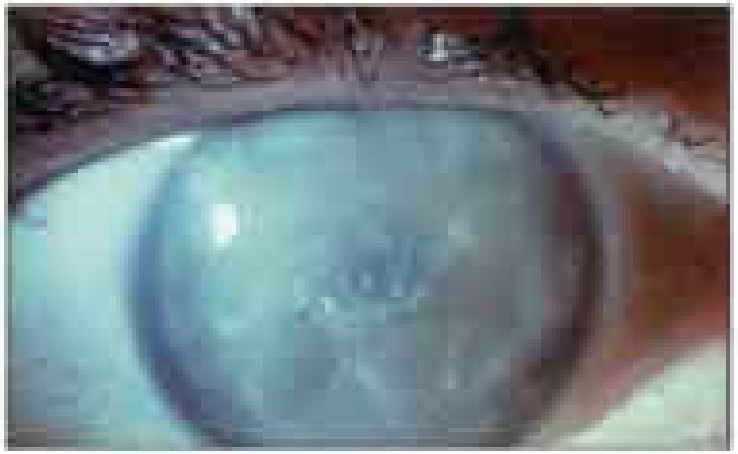
Dry Clothing or Dry Covering	Condition of Air	Correction Factor
Naked	Moving	0.75
One or two thin layers	Moving	0.9
Naked	Still	1.0
One or two thin layers	Still	1.1
Two or three thin layers	Still	1.2
One or two thin layers	Moving or still	1.2
Three or four thin layers	Moving or still	1.3
More than four thin layers	Moving or still	1.4
Thick bedspread and clothing combined	Moving or still	2.4

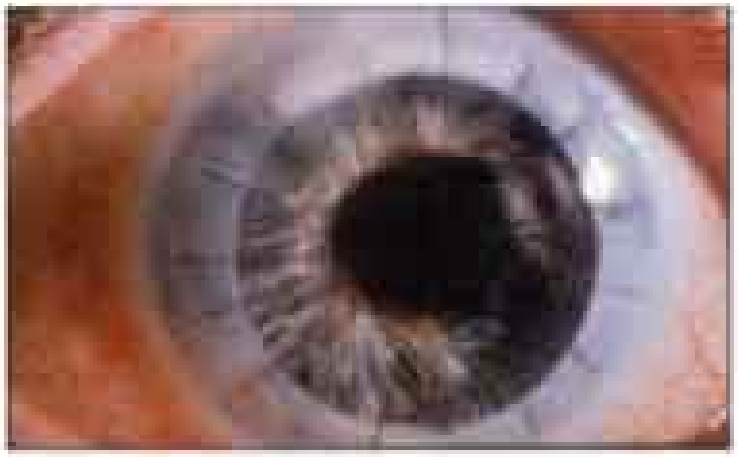
NOMOGRAM: USING CORRECTION FACTORS

1. Rectal Temperature
2. Ambient Temperature
3. Draw line connecting
4. Draw 2nd line from crosshairs through intersection
5. CALCULATE Mass (in kg)
6. Use 2nd crosshairs line to find TOD on the corrected mass line
7. Apply variations
8. Count backwards from discovery to death



Ocular Changes





Eye Part	Open/Closed	Onset
Corneal film	Open	minutes
	Closed	hours
Scleral discoloration	Open	Minutes-hours
Cornea cloudiness	Open	2 hours
	Closed	Up to 24 hours
Cornea Opacity		3 days

Stomach Contents

Size of Meal Time in Stomach
(Starts to empty within 10 minutes)

Meal Size	PMI
Light	0.5-2 hours
Medium	3-4 hours
Heavy	4-6 hours

Insects and PMI

Forensic Entomology is the study of decomposer insect activity in order to give the most accurate determination of PMI.

Summary

PMI Changes	Definition	Onset*	Loss*	External Factors
Rigor Mortis	Muscular contraction	3-12 hrs	72 hrs	> Temp = > rate of Rigor mortis < Temp = < rate of Rigor mortis
Livor Mortis	Pooling of blood; lividity /hypostasis	30min - 2hrs	6-12 hrs it becomes fixed**	Body position, weight, skin color, body temperature, toxicity
Algor Mortis	Cooling of body			↑ Temp = ↑ rate of algor mortis ↓ Temp = ↓ rate of algor mortis Clothing/covering of body will slow the process; environmental conditions must be considered
Ocular Changes	Corneal Film	Minutes-hrs		Eyes open or closed
	Sclera Discolored	Minutes-hrs		
	Cornea Cloudy	2-24 hrs		
	Cornea Opaque	3 days		
Stomach Contents	Light	0.5-2 hours to empty		Caloric content, age, psychological state/stress levels, disease, when they last ate, what they ate, etc.
	Medium	3-4 hours to empty		
	Heavy	4-6 hours to empty		

*These are approximate figures and subject to variation

**not consistent in <u>all</u> cases; in some cases livor can remain unfixed for days even up until decomposition – not incredibly reliable for PMI due to variability

Additional Resources:

http://forensicpathologyonline.com/index.php?option=com_content&view=category&layout=blog&id=49&Itemid=75

http://colbycriminaljustice.wikidot.com/medicolegal-investigation1

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http://www.intechopen.com/books/forensic-medicine-from-old-problems-to-new-challenges/death-scene-investigation-from-the-viewpoint-of-forensic-medicine-expert

Fig. 1. Macroscopic view of traumatic head separation with full thickness interruption of the C4–C5 cervical tract and complete resection of the spinal cord.

Fig. 2. Detail of section of the head separation where the injury edges appear generally irregular and infiltrated with blood; signs of abrasion under the chin.

What's next?

Forensic Specialist Introduction

Forensic Specialist Project

Eyewitness testimony and types of evidence

Crime scene search & JonBenet