

GASTROINTESTINAL TRACT

Mechanical and chemical processing of food

Absorption and excretion of products

Protection of internal environment (toxins, microbes...)

Motility, secretion, digestion, absorption, storing, excretion

GIT motility – mainly nervous control

Secretion in GIT – mainly humoral control

Transport mechanisms, liver function

+

PARASYMPATICUS

(preganglionic cholinergic fibres)
n.VII, n.IX, n.X, nn.pelvici (S2-S4)

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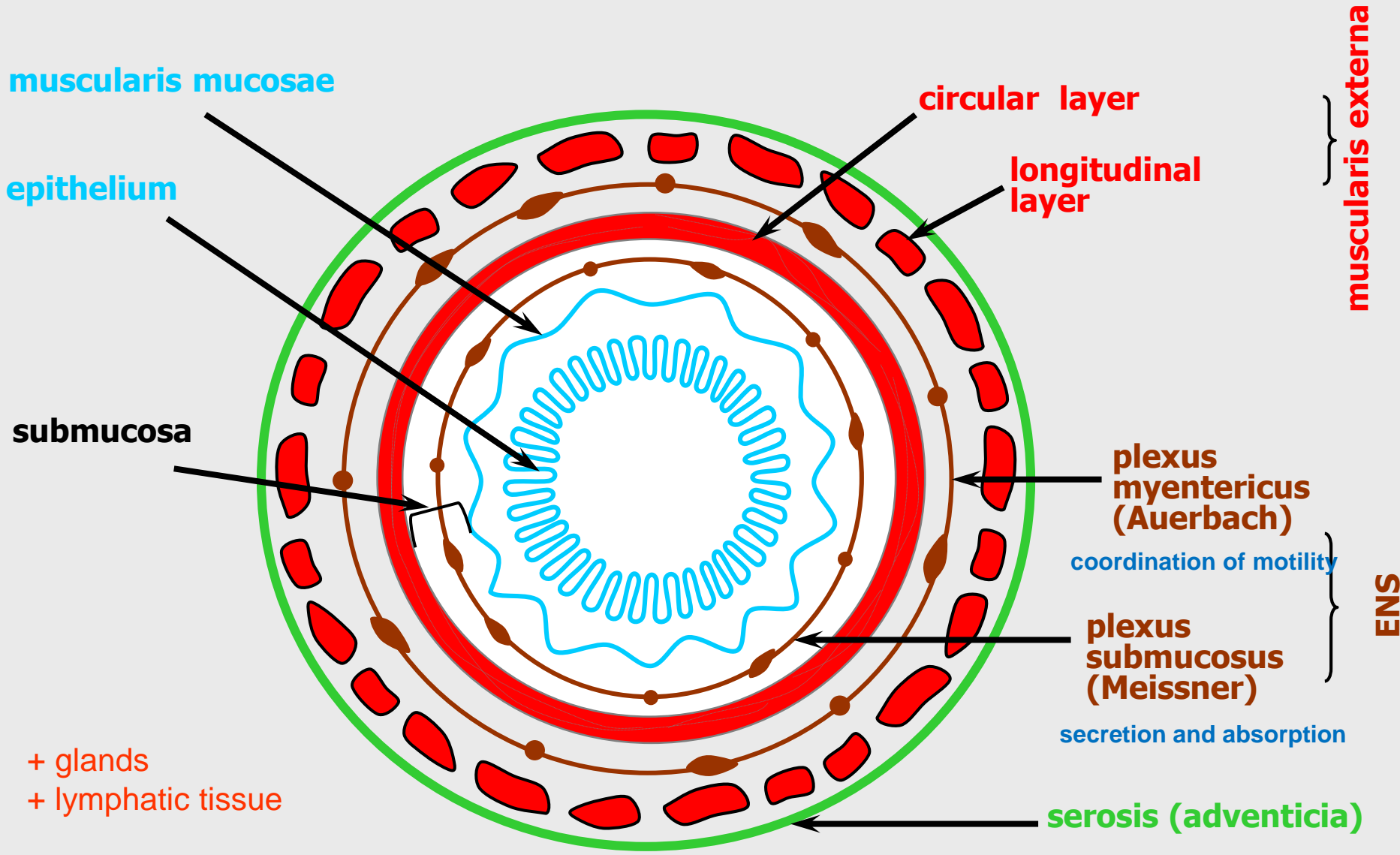
SYMPATICUS

(postganglionic adrenergic fibres)
Th5-L2

(tonus and motility -)

(vasoconstriction)

(musc.mucosae, sphincters +)



Circular muscle layer: inhibitory fibers, contraction – gut is longer and smaller in diameter
Longitudinal muscle layer : no inhibitory fibers, contraction – gut is shorter and bigger in diameter

ENTERIC NERVOUS SYSTEM

(plexuses + endings of sympathetic and parasympathetic nervous system + other GIT neurons)

Control of:

- GIT motility
- GIT secretion
- GIT vasomotor control

Chemoreceptors, mechanoreceptors, thermoreceptors...
(mucosa, musc. externa)

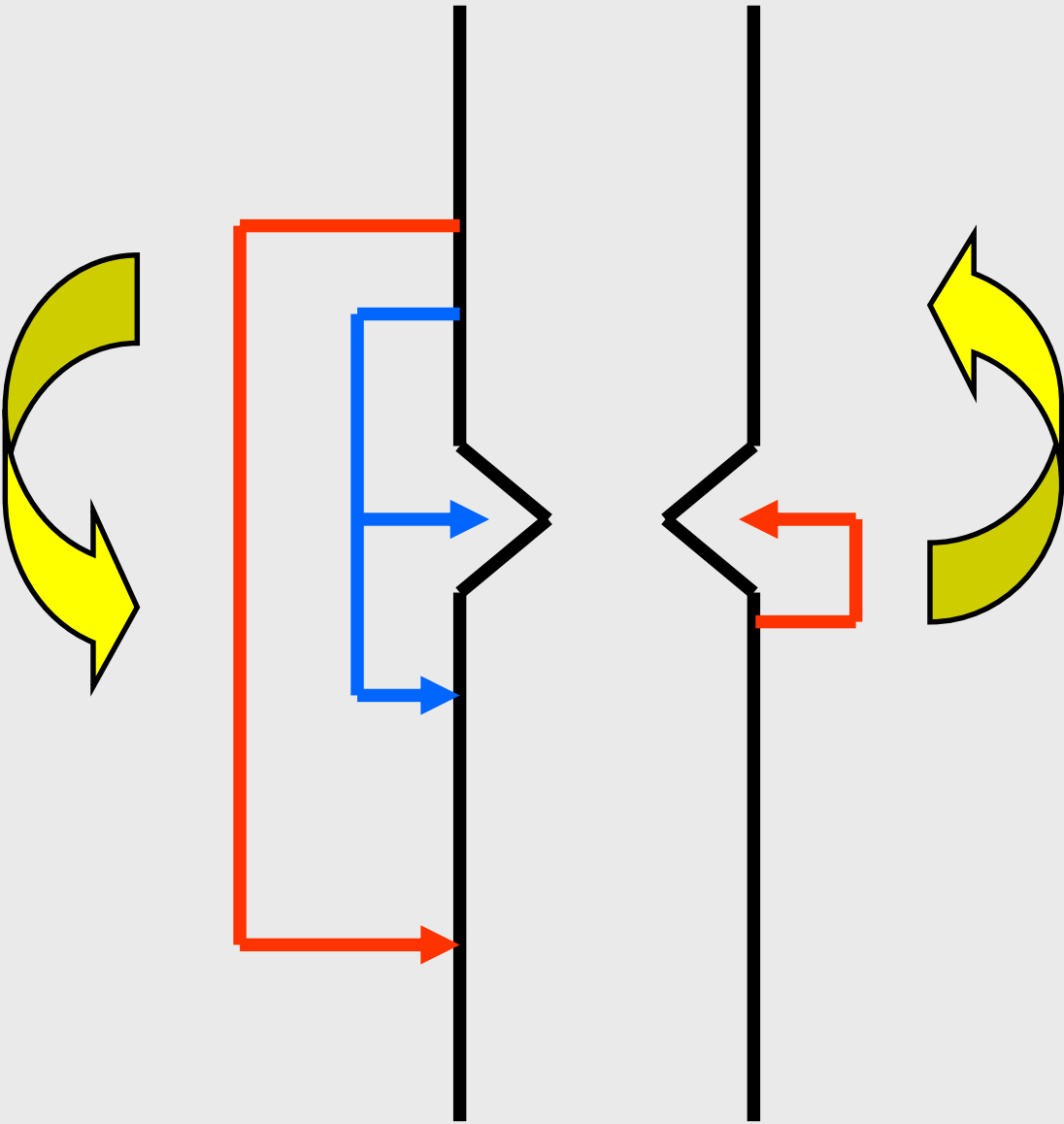
Mediators and modulators:

Ach, VIP, NOR, DOPA, serotonin, histamine, AT II, PG
somatostatin, enkephalin, GABA, TRH, neuropeptide Y, substance P
secretin, GIP, glucagon, gastrin, CCK, G-releasing peptide
(Secretin group)
(Gastrin group)

Local (short) reflexes

Central reflexes

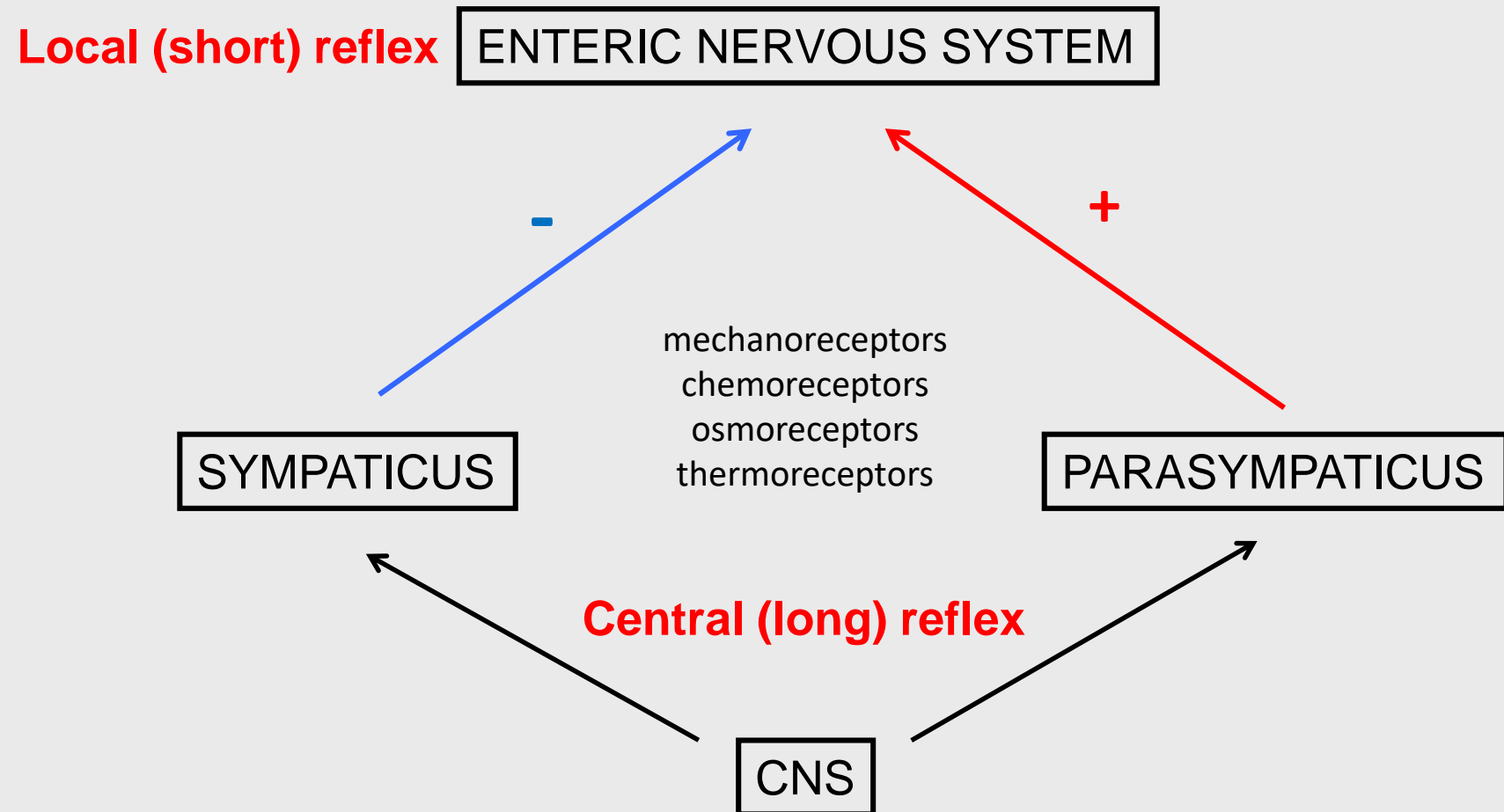
Continuous tonus of
S, PS



FORWARD SIGNALS : SPEED UP, OPEN THE WAY

BACKWARD SIGNALS: SLOW DOWN, CLOSE THE WAY

GIT INNervation



ELECTROPHYSIOLOGY OF GI SMOOTH MUSCLE

Resting potential:

from -40 to -80mV (\uparrow gNa : \downarrow gK)

Lower activity of Na⁺/K⁺-ATPase

Slow waves (oscillation of rest.MP)

3 (stom.) – 12(duod.)/min – **basal electric rhythm**

Spike (AP)

low voltage, depolarisation – Na⁺ and Ca²⁺, 1-10/sec
automacy

Pacemaker cells in ENS

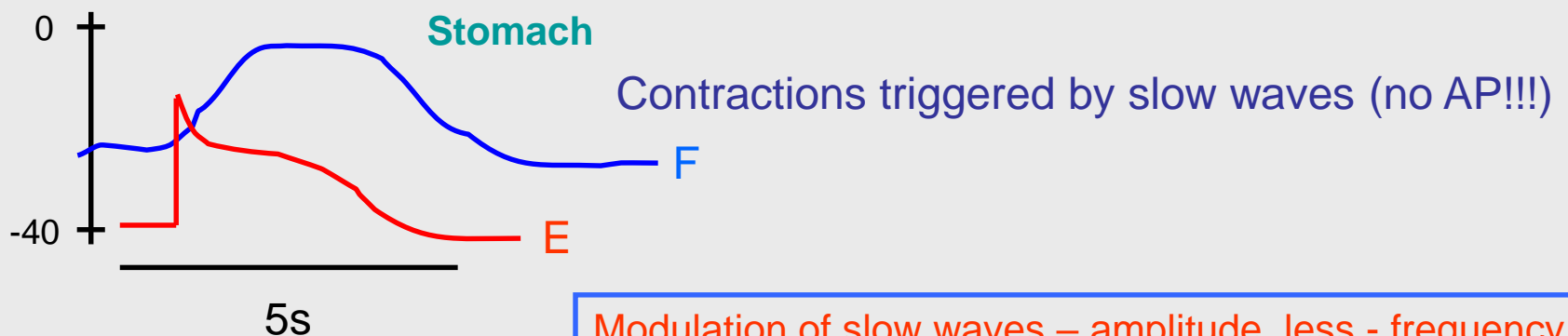
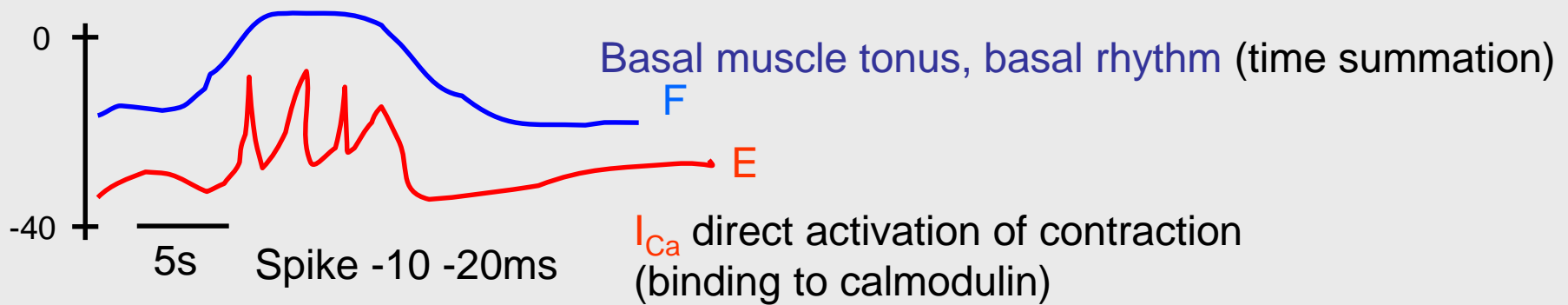
neurohumoural regulation

Variability

Innervations: nexus, innervations of circular muscle >> longitudinal muscle

No motor endplate

Ach, ENS, exceptions



Modulation of slow waves – amplitude, less - frequency

GIT MOTILITY

CONTRACTIONS

tonic (stomach, colon)

rhythmic

MOVEMENTS

propulsive (peristalsis, myenteric reflex)

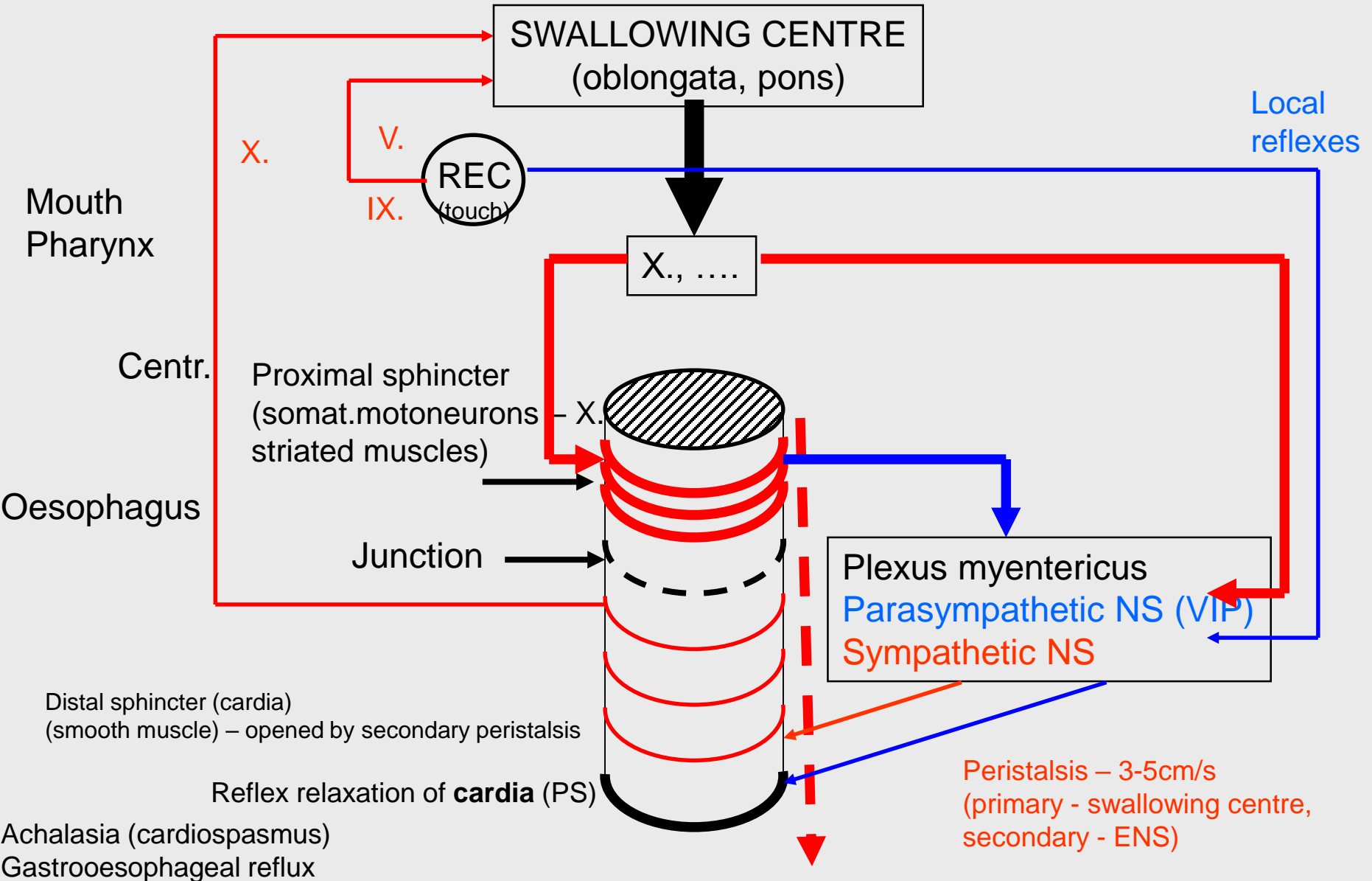
mixing

Receptive relaxation.

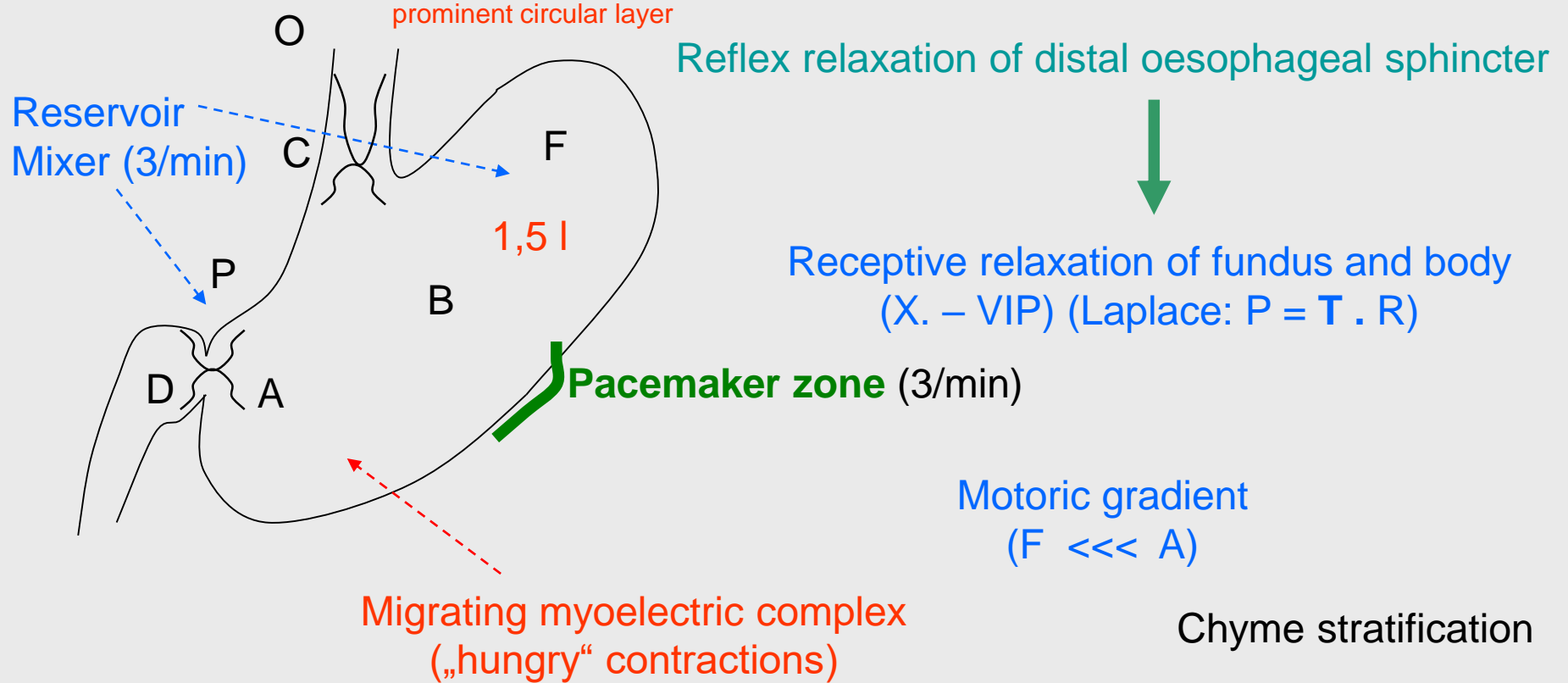
SWALLOWING

- **Oral** phase (voluntary)
- **Pharyngeal** phase (reflex) < 1s
- **Oesophageal** phase (peristaltic)

Food – chewing (voluntary and reflex)
 Saliva (1.5 litres / day)
 Frequency of swallowing – approx. 600x / day



GASTRIC MOTILITY



1-2 hour: rest

10-20 min: activity, during fasting is stronger

PYLORUS = sphincter ???

Common ENS with bulbus duodeni

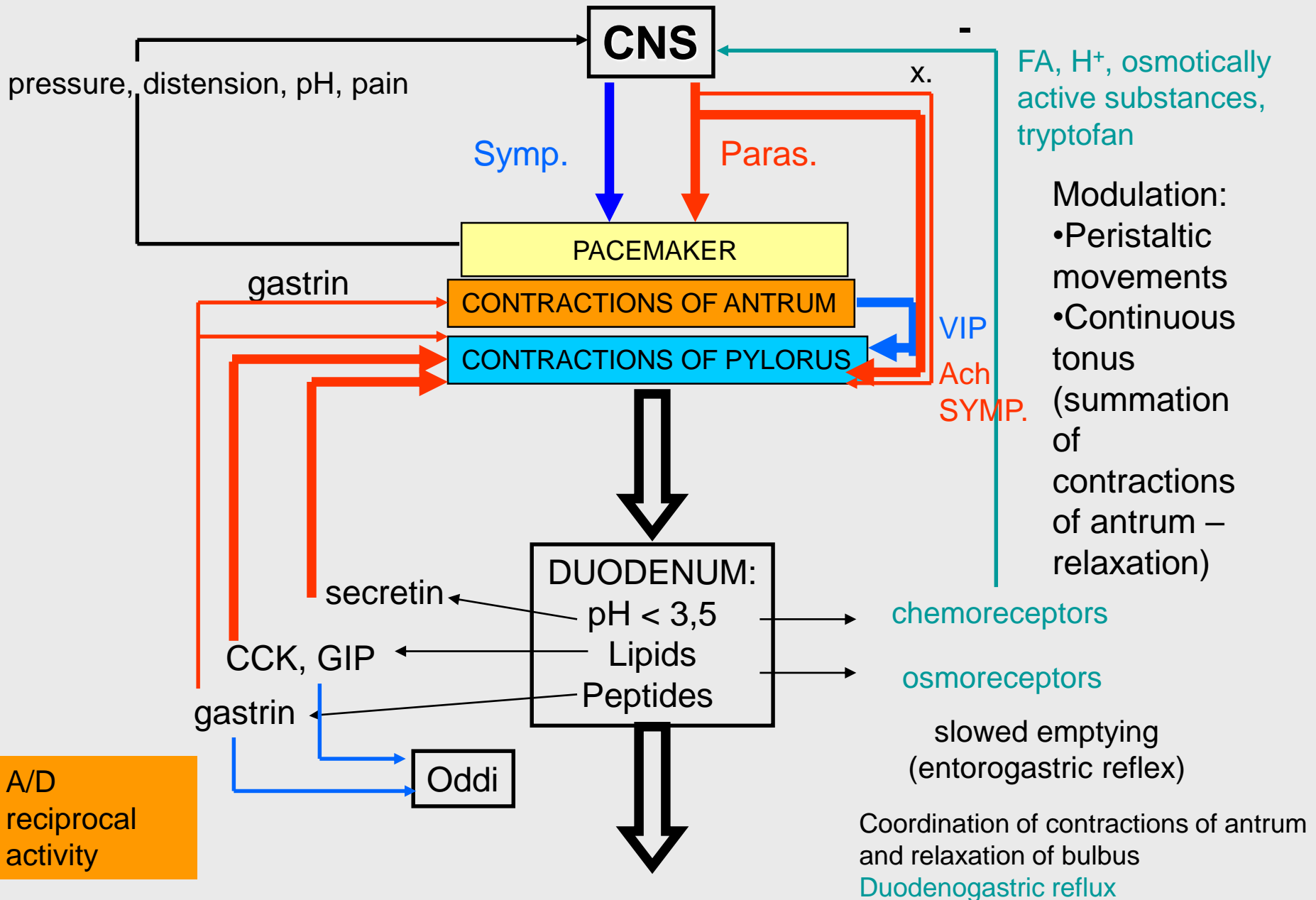
Smooth muscle

sympaticus +++, n.X. --- (VIP)

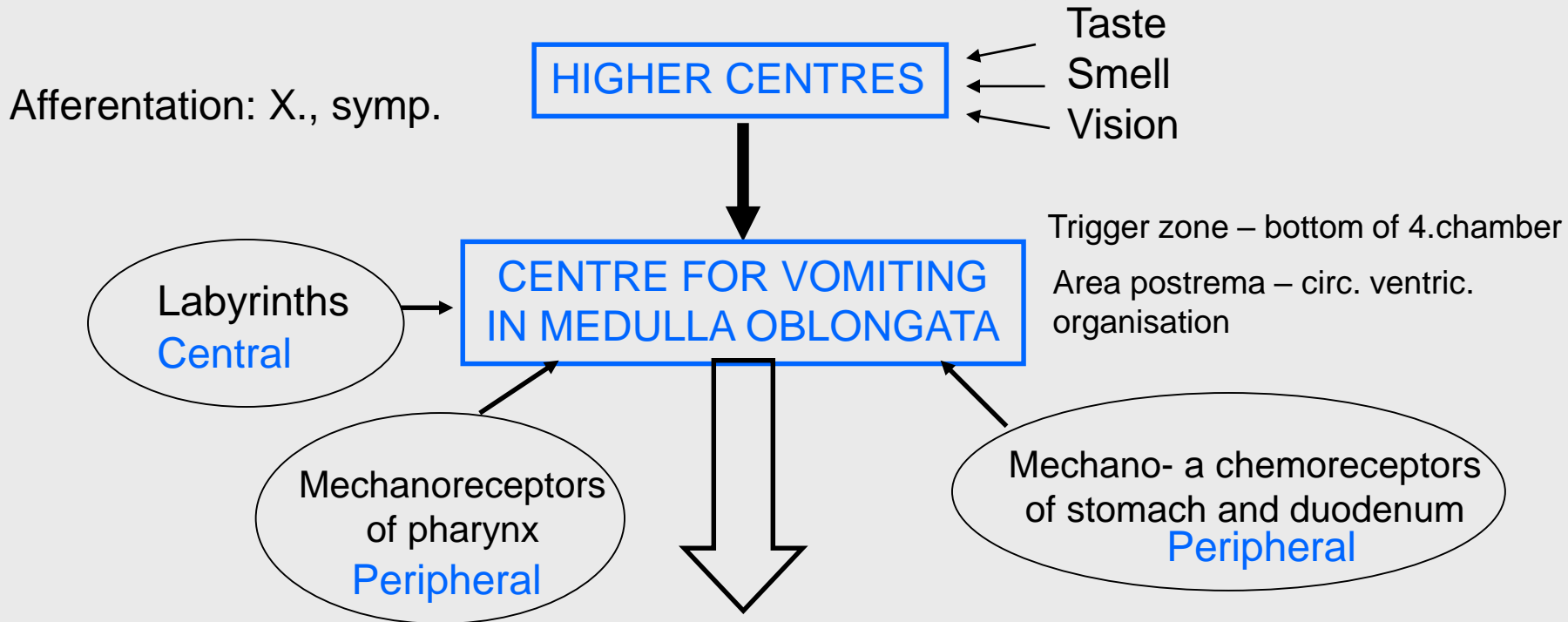
N. vagus +

Plexus cealicus -

EMPTYING OF STOMACH



VOMITING (PROTECTION)



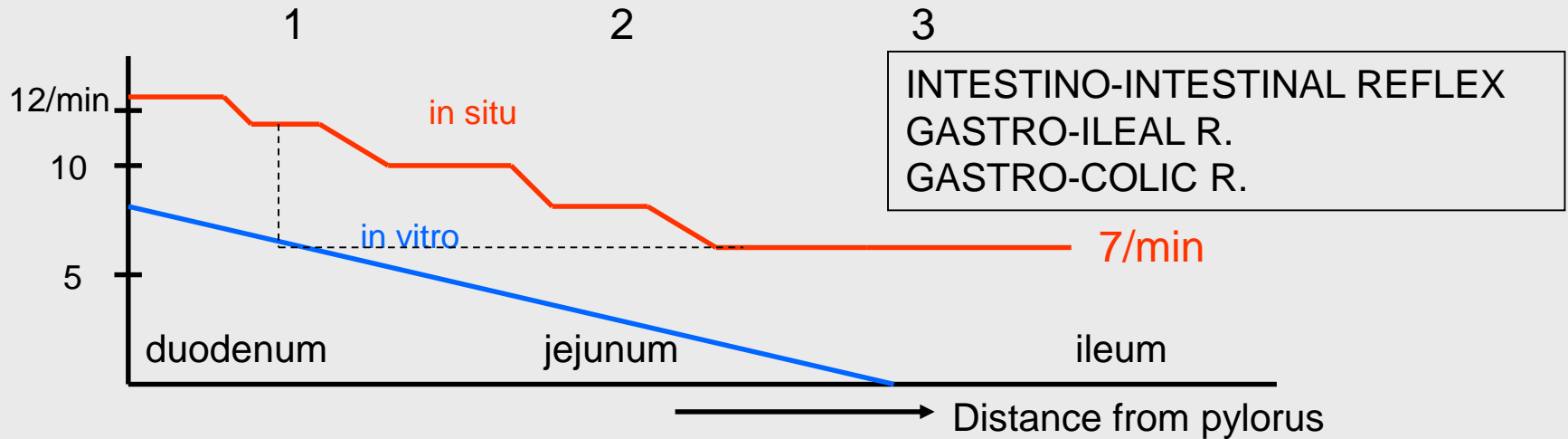
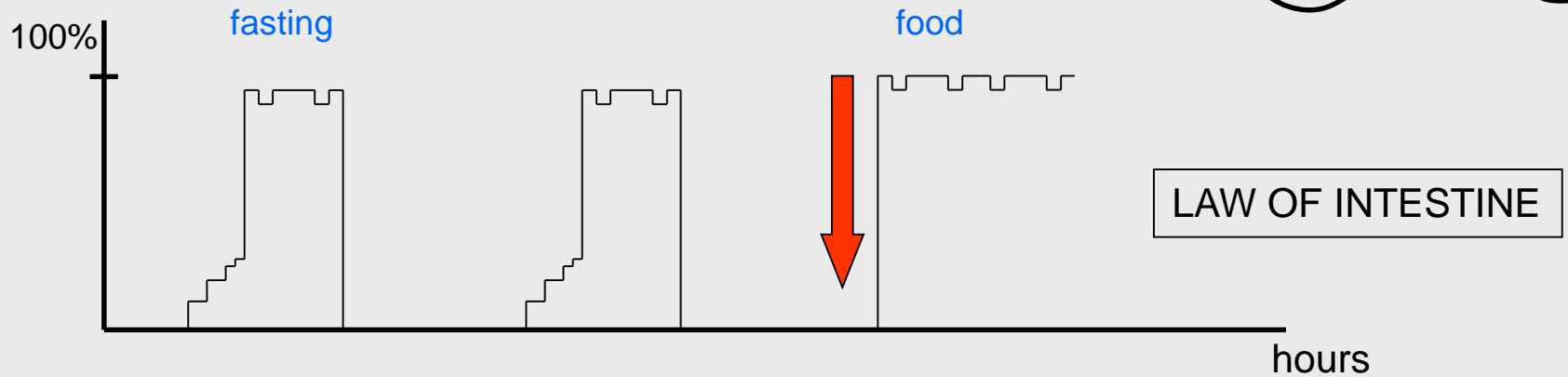
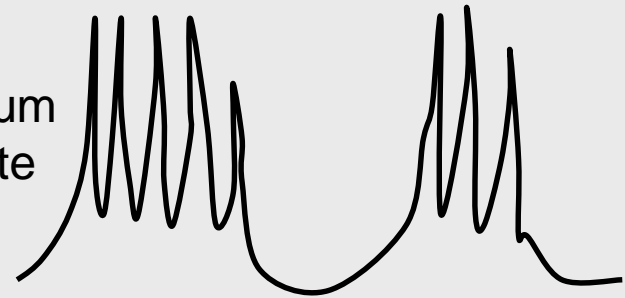
- Antiperistalsis in jejunum and duodenum
- Relaxation of pylorus and antrum
- Contractions of diaphragm (increased intraabdominal pressure)
- Inverse Valsalva manoeuvre (decreased intrathoracal pressure)
- Contractions of pylorus and antrum
- Relaxation of cardia
- Relaxation of upper pharyngeal sphincter

Emetics: central
peripheral

Antiemetics

MOTILITY OF SMALL INTESTINE

- Slow waves – approx. 11-13/min in duodenum, 8-9 - ileum
- „Minute“ rhythm (jejunum) – salvos approx. every minute
- Hour rhythm (migrating myoelectric complex)

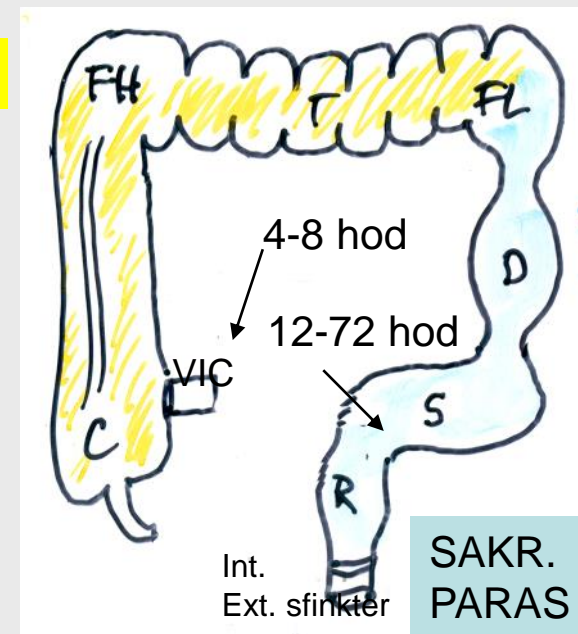


Segmentation >>> peristalsis (up to 10 cm)

MOTILITY OF COLON

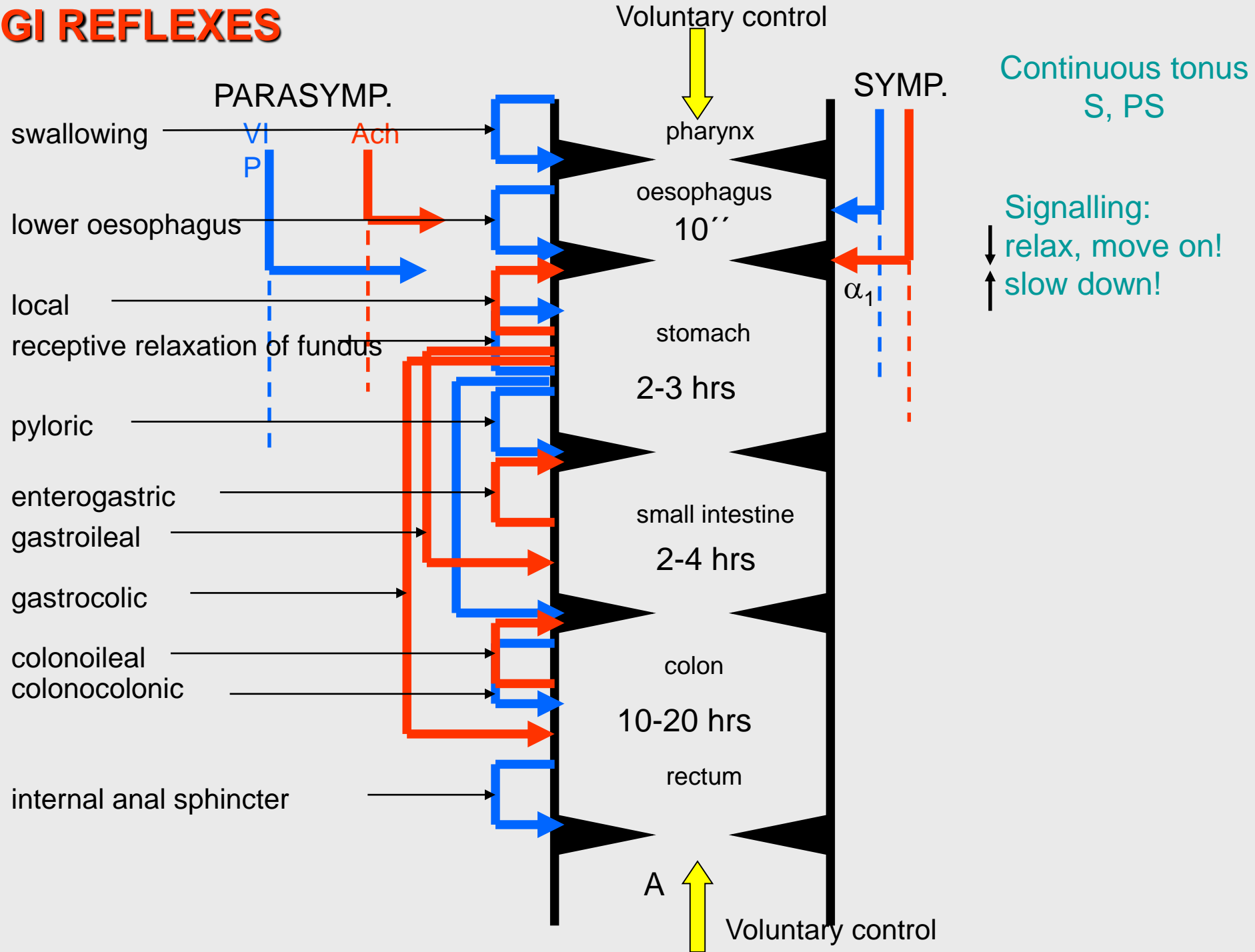
- Slow waves with frequency 4 – 6 / min
- Segmentation = **haustra**; 5-10 cm/hour – **pendulum movements**
- **Mass peristalsis**; 1-3/day – „sweeping“
- Reverse peristalsis – in proximal colon („delay“ – absorption of water and ions)
- Control of anal sphincter: int. – reflex, ext. – voluntary (+reflex)
- Defecation: abdominal muscles +++, muscles of pelvic bottom –
- Reflex: colono-colonic, gastro-colic

PS



- Parasympathetic + (X. till FL)
- Sympathetic – (L2 – L4)

GI REFLEXES



GI REFLEXES

Superposed on basal tonus

PS and S (sphincters S PS)

R. lower oesophagus

Pyloric r. (X.)
PS and S

Enterogastric r.
(chemoreceptors)

Reciprocal
function of long.
and circ. muscle

Innervations of only circ. muscle

Motility is increased:

- CCK
- Substance P
- Gastrin

Colono-ileal r. (+)

Colono-colonic r.

- Mass peristaltic movements
- Haustra, segmentation
- Reverse peristalsis

