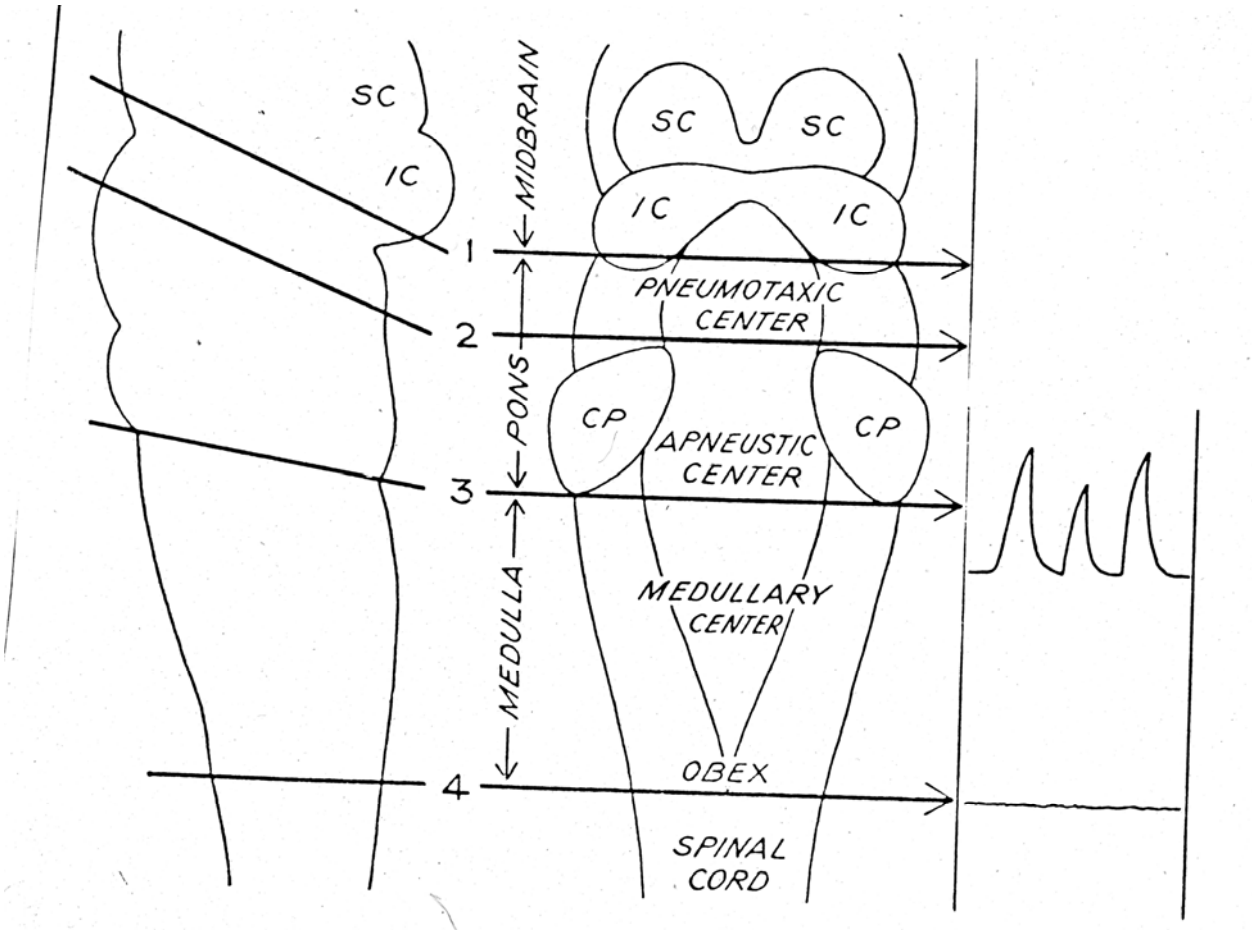
3 Components of Respiratory Control System

1. Central Neural Activity
2. Peripheral Sensory Neural Feedback
3. Chemical Status of Blood and CSF


SC
IC
SC
SC
IC
IC
MIDBRAIN
1
PNEUMOTAXIC
CENTER
2
PONS
CP
APNEUSTIC
CENTER
CP
3
MEDULLA
MEDULLARY
CENTER
OBEX
4
SPINAL
CORD

MEDULLARY CENTER
RECORDINGS

V_T ml

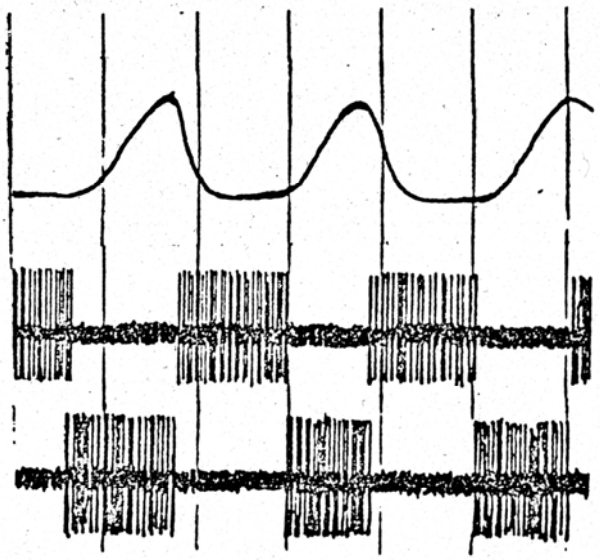
20

0

From:

VRG, NRA — EXPIRATORY NEURAL ACTIVITY

DRG, NTS — INSPIRATORY NEURAL ACTIVITY



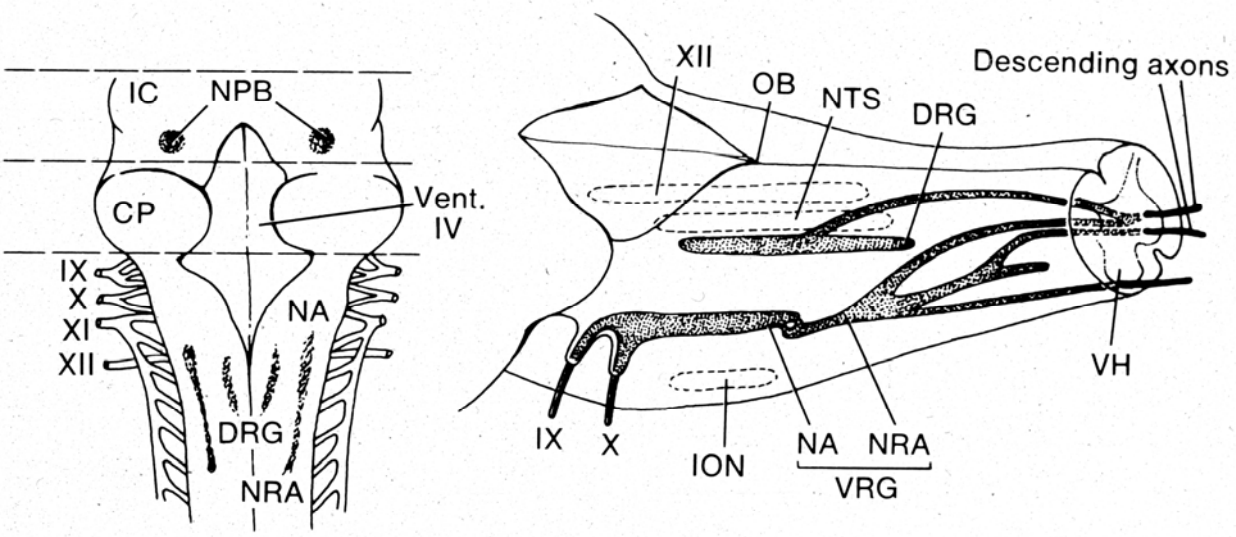
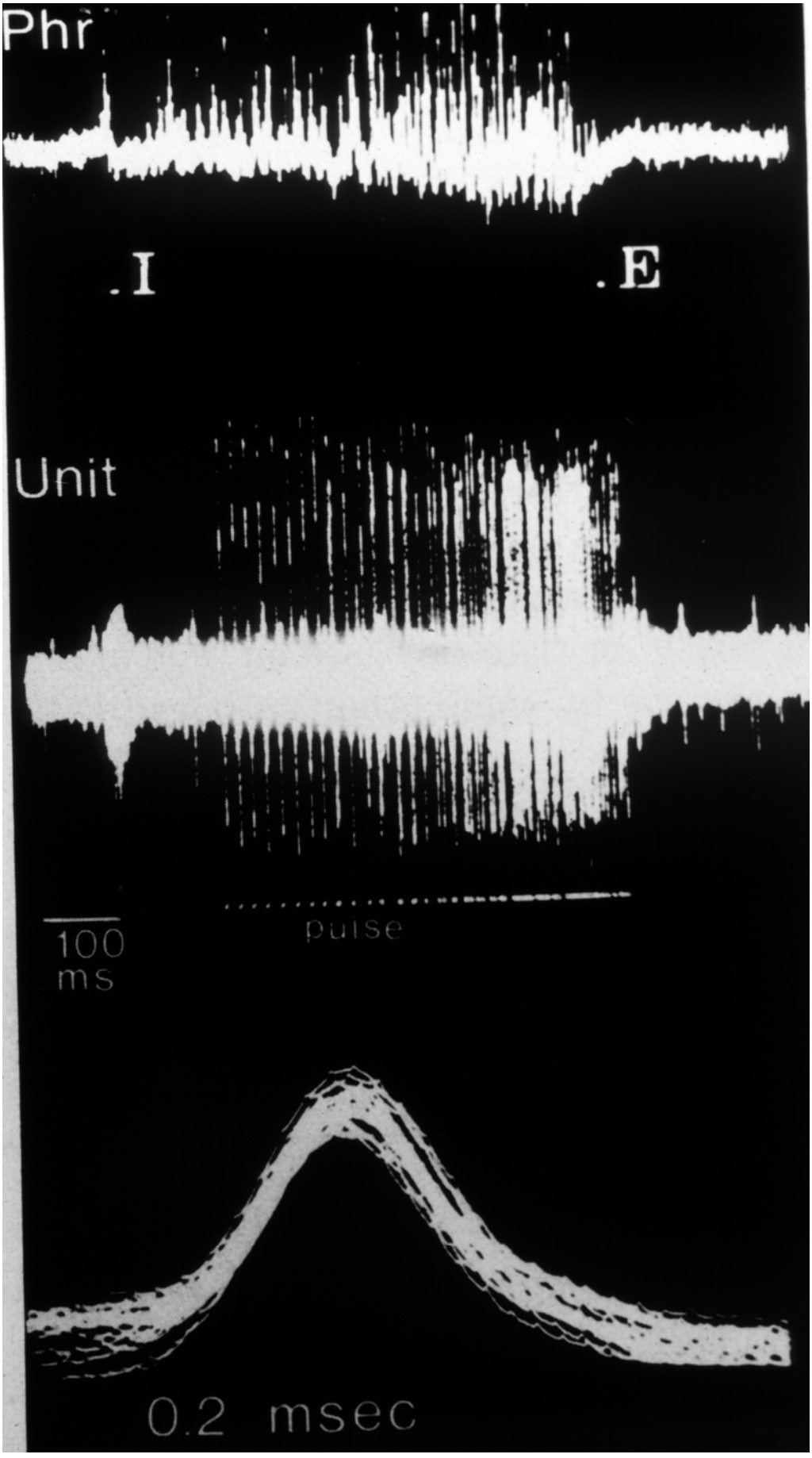
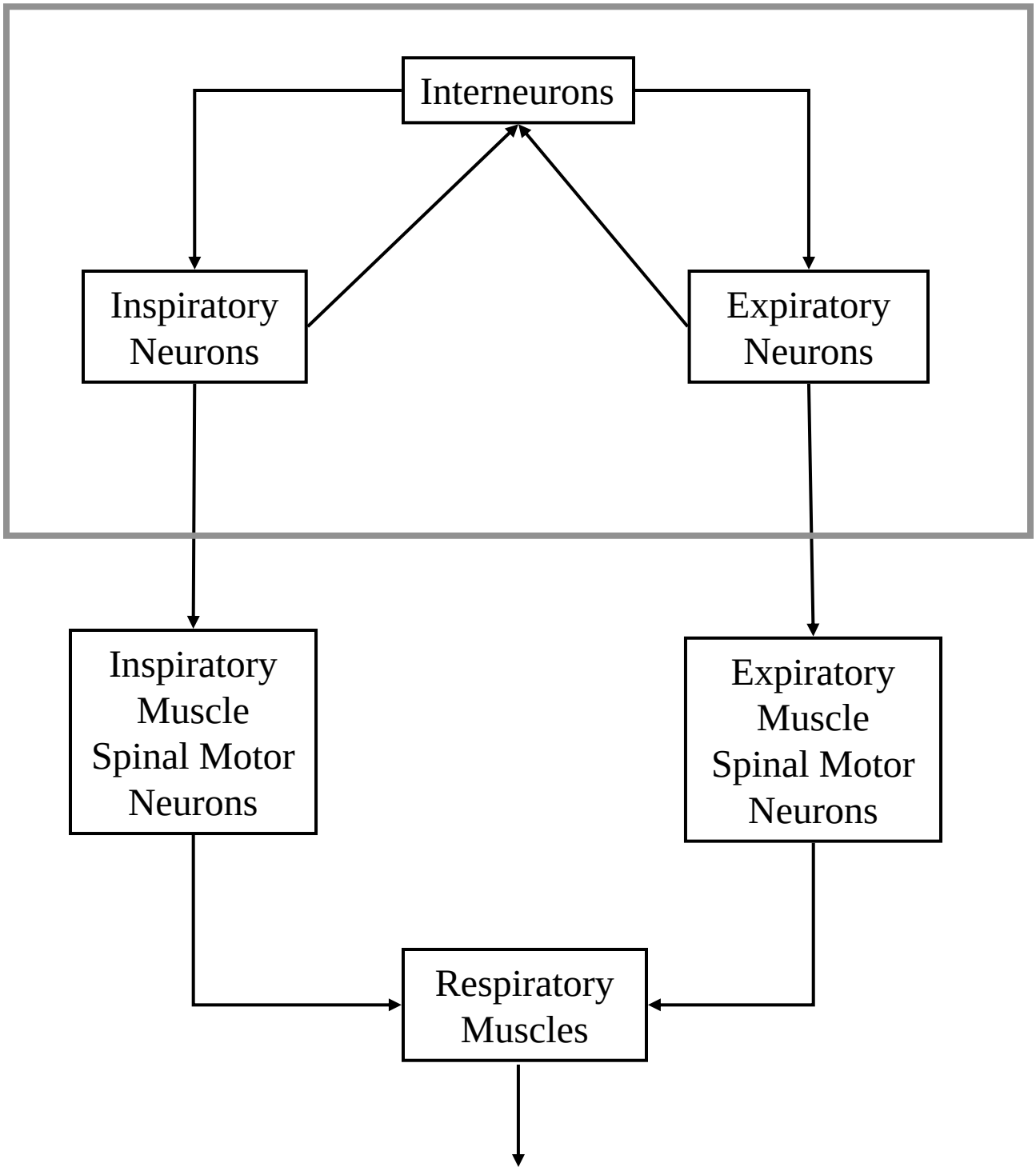
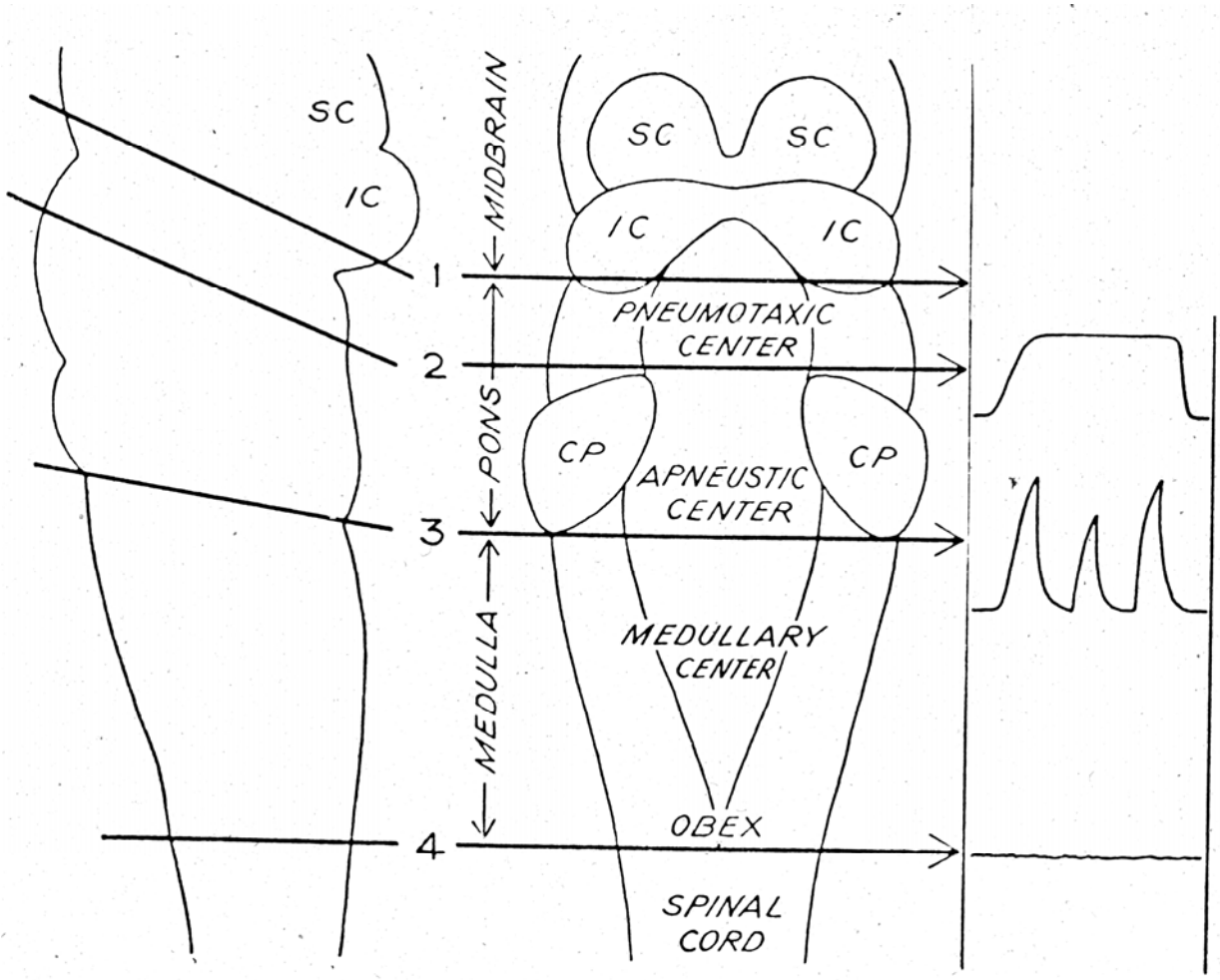


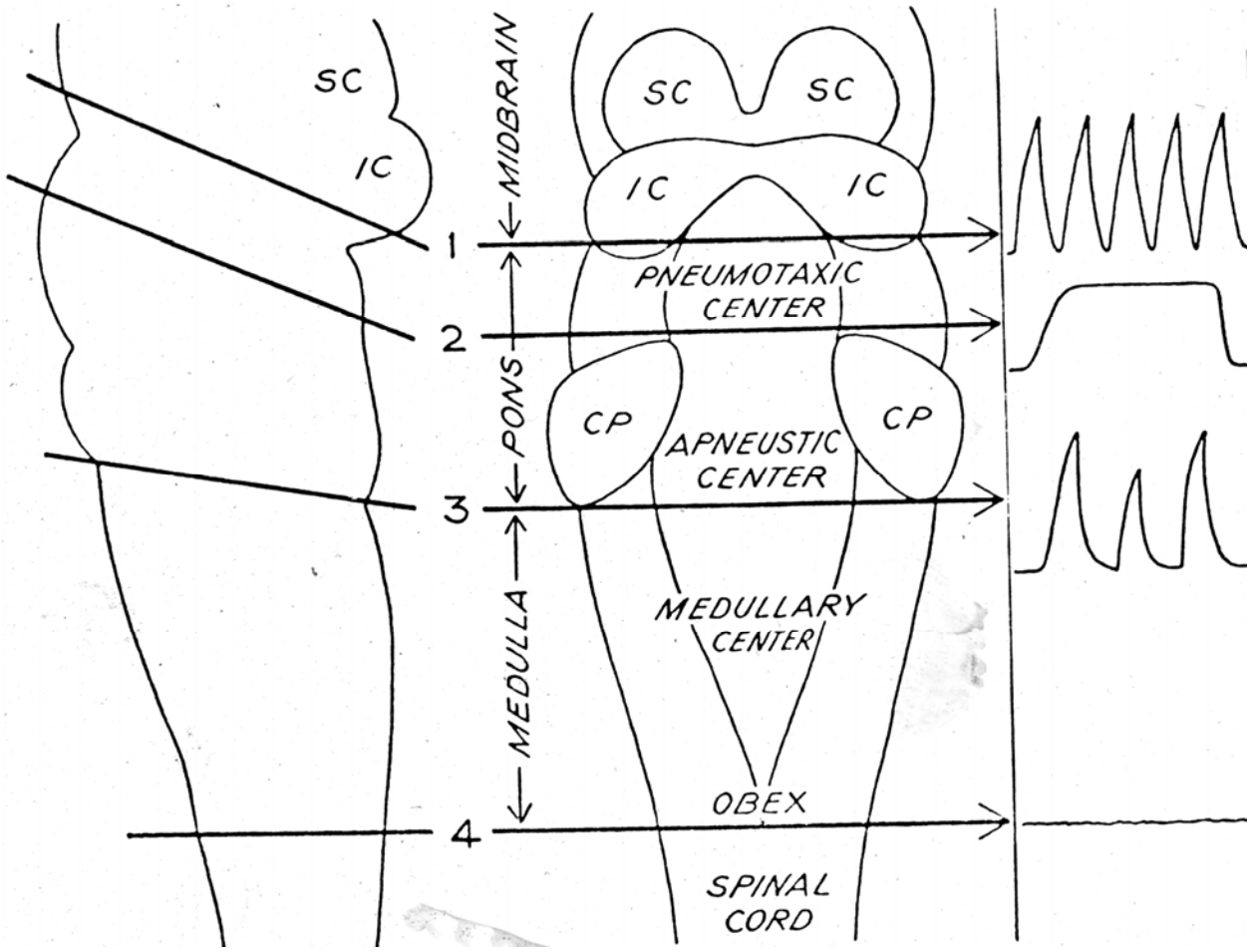
FIGURE 7-14. Dorsal (A) and dorso-lateral (B) views of cat brain stem to show the dorsal (DRG) and ventral (VRG) respiratory groups and their projections. NPB, nucleus parabrachalis; IC, inferior colliculus; CP, cerebellar peduncle; NA, nucleus ambiguus; NRA, nucleus retroambigualis, OB, OBEX; NTS, nucleus tractus solitarius; ion, inf. olivary nuc.; VH, ventral horn. (Modified from R. A. Mitchell and A. J. Berger. *Ann. Rev. Respir. Dis.* **111**: 206–224, 1975.)

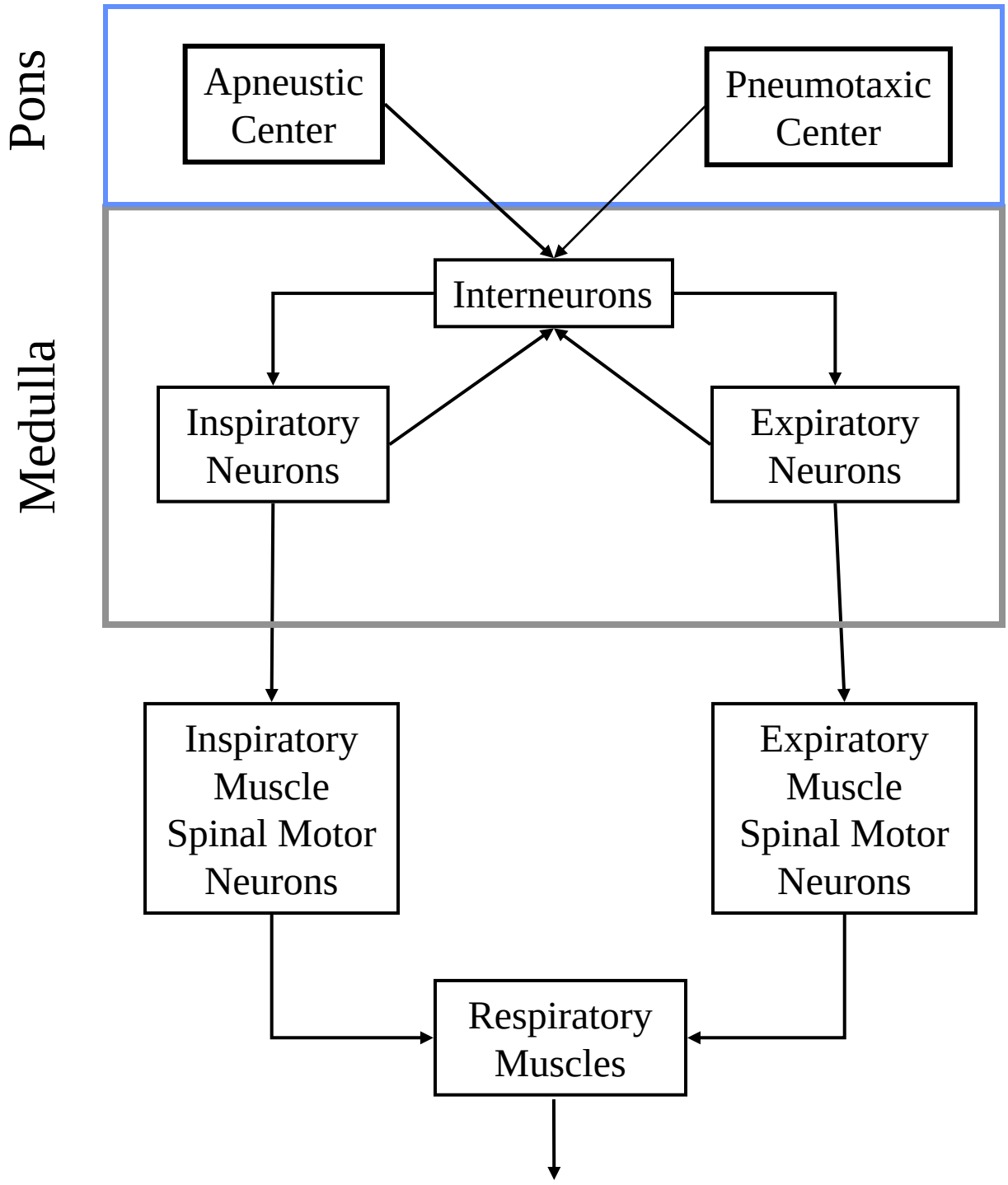

Phr
.I
.E
Unit
pulse
100
ms
0.2 msec

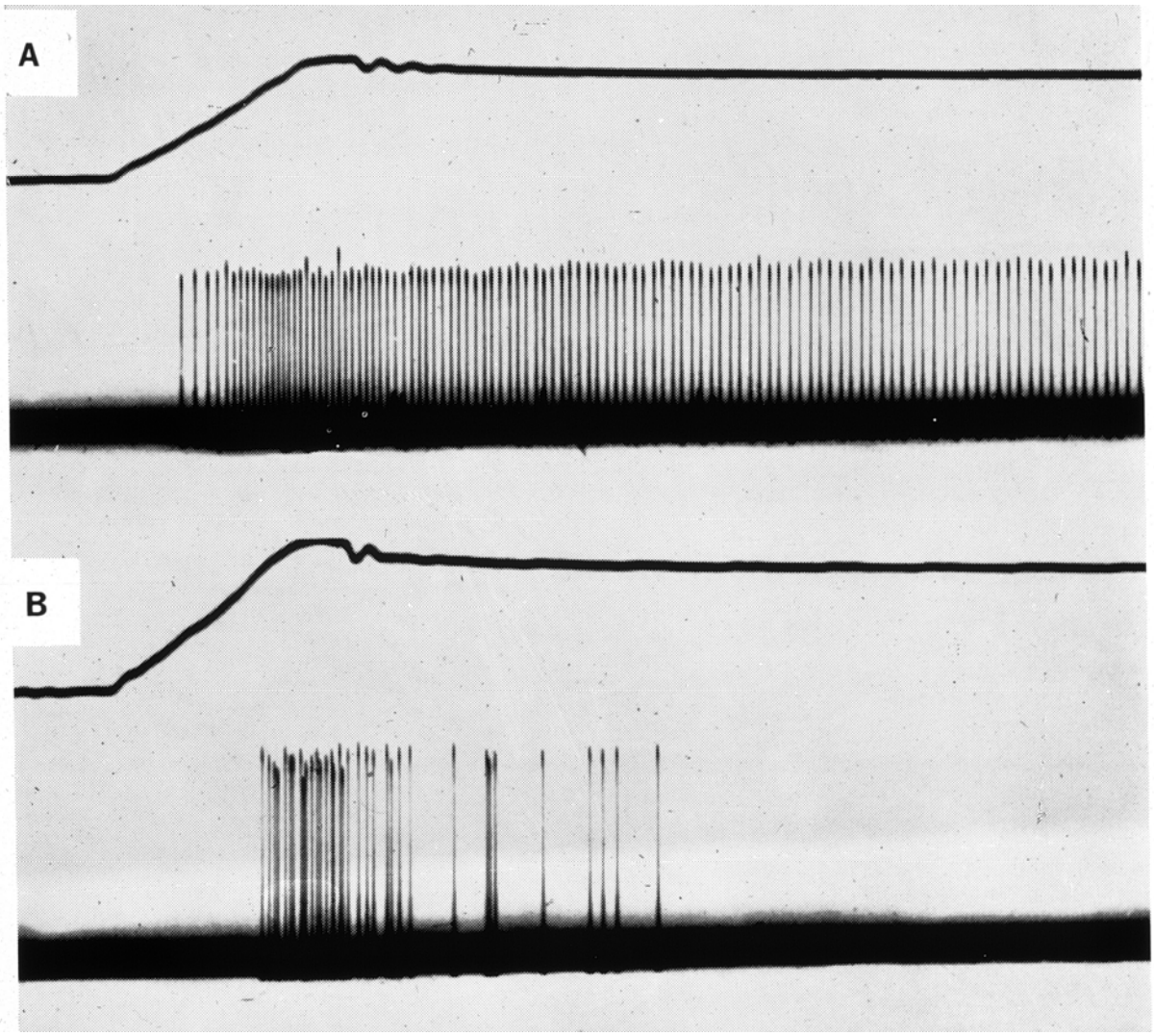
Respiratory Control Neural Network

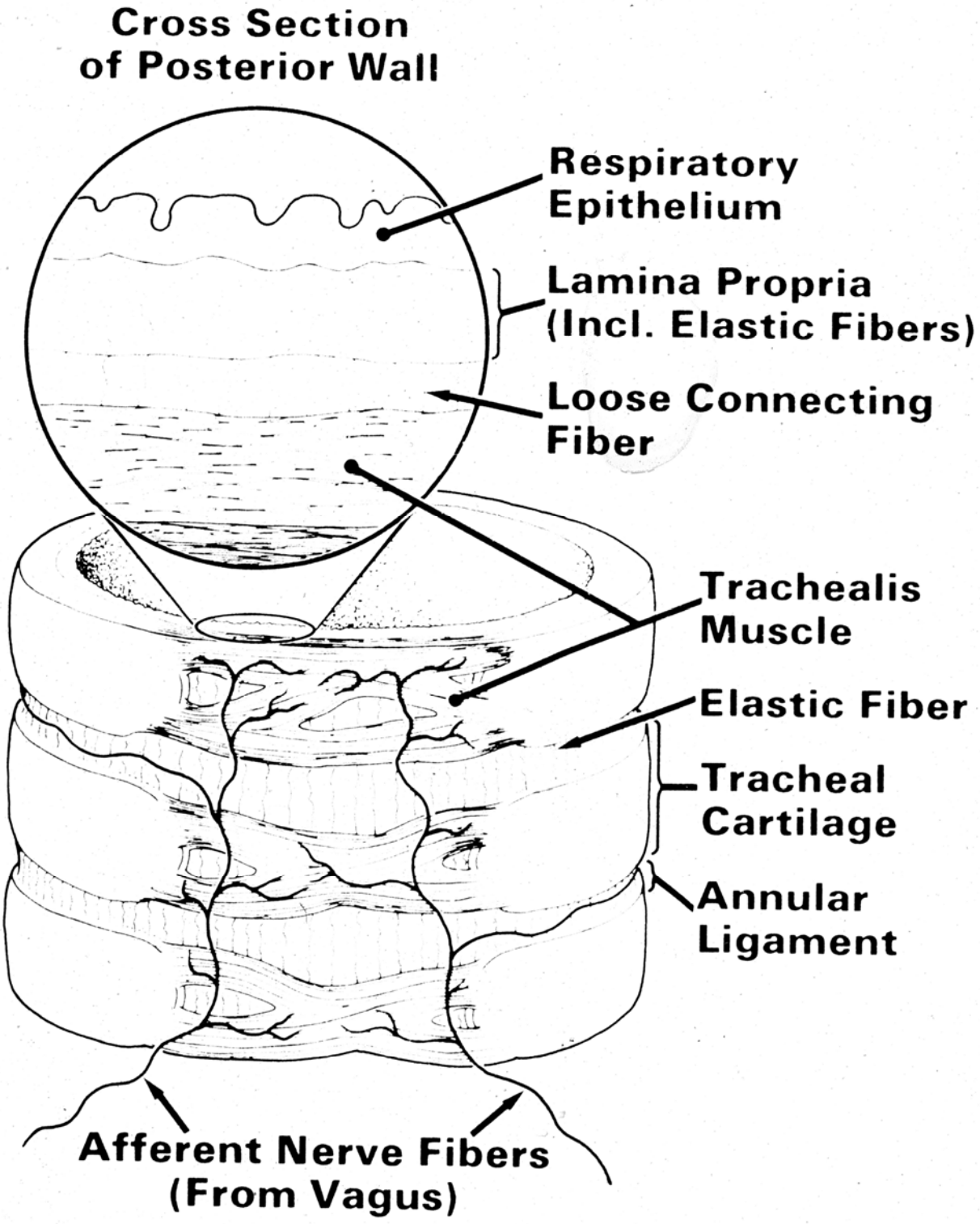


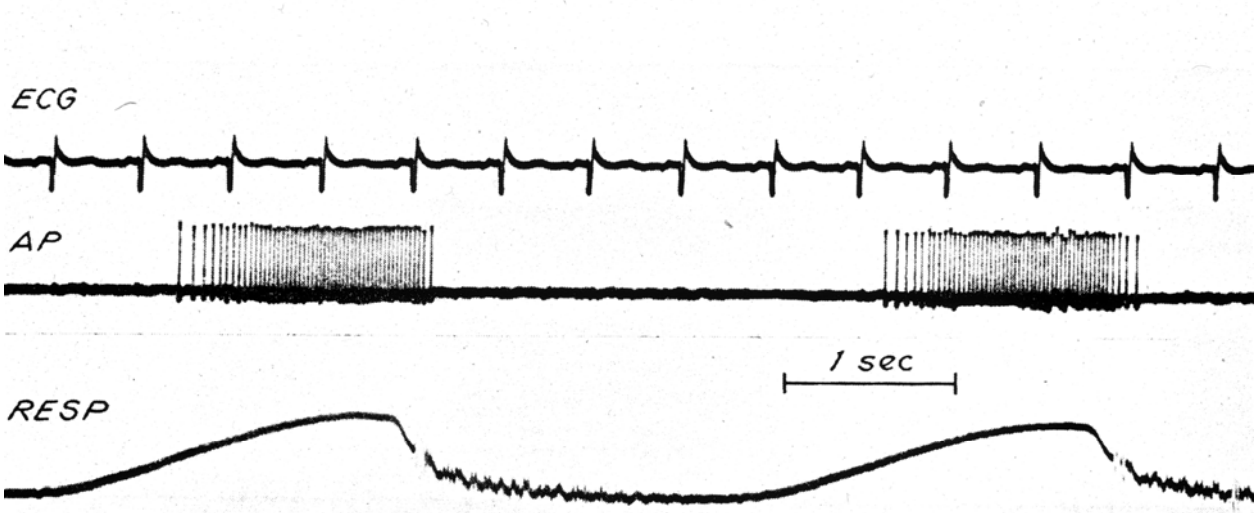

SC
IC
SC
SC
IC
IC
MIDBRAIN
1
PNEUMOTAXIC
CENTER
2
PONS
CP
APNEUSTIC
CENTER
CP
3
MEDULLA
MEDULLARY
CENTER
OBEX
4
SPINAL
CORD


SC
IC
SC
SC
IC
IC
MIDBRAIN
1
PNEUMOTAXIC
CENTER
2
PONS
CP
APNEUSTIC
CENTER
CP
3
MEDULLA
MEDULLARY
CENTER
OBEX
4
SPINAL
CORD


Pons
Medulla
Apneustic Center
Pneumotaxic Center
Interneurons
Inspiratory Neurons
Expiratory Neurons
Inspiratory Muscle Spinal Motor Neurons
Expiratory Muscle Spinal Motor Neurons
Respiratory Muscles


A
B


Cross Section
of Posterior Wall
Respiratory
Epithelium
Lamina Propria
(Incl. Elastic Fibers)
Loose Connecting
Fiber
Trachealis
Muscle
Elastic Fiber
Tracheal
Cartilage
Annular
Ligament
Afferent Nerve Fibers
(From Vagus)


ECG
AP
1 sec
RESP

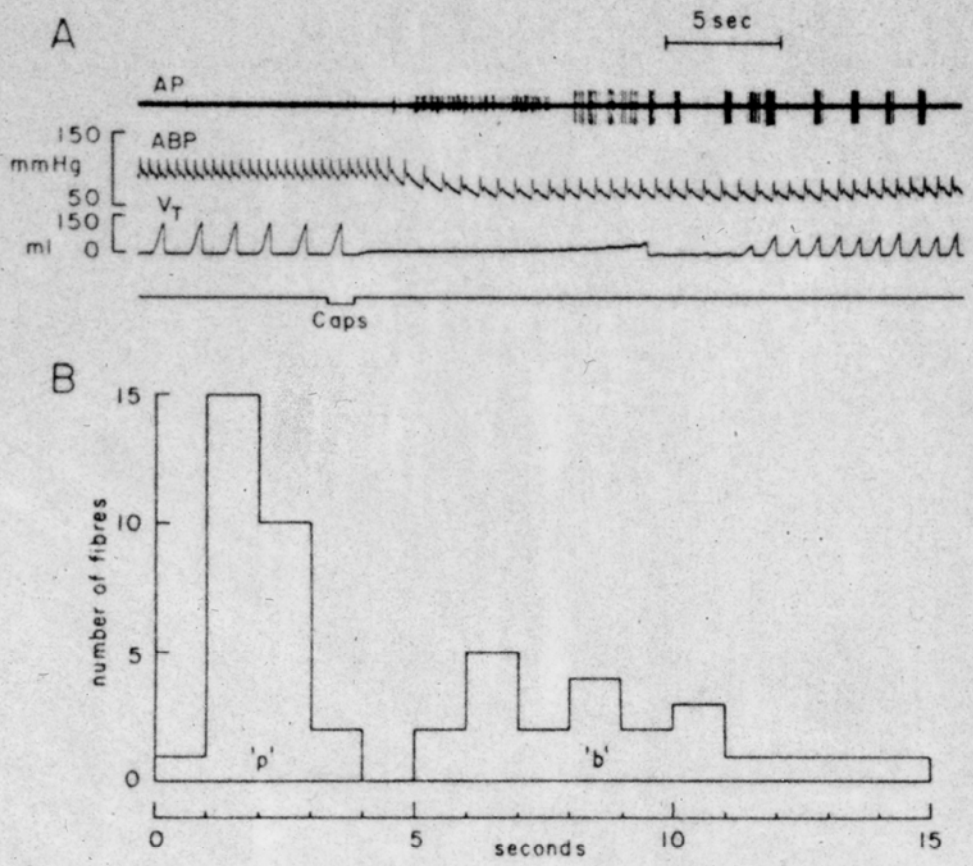
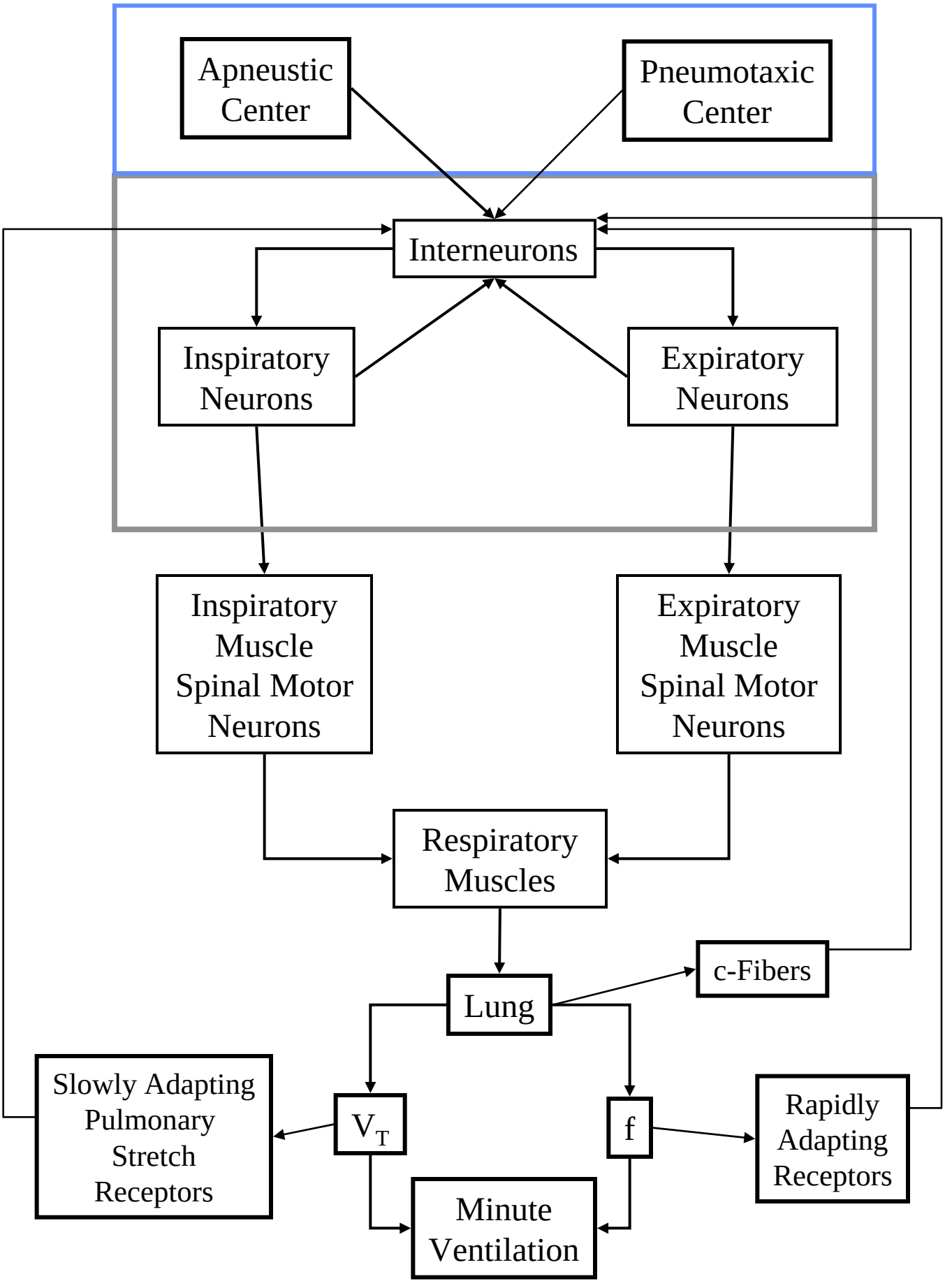
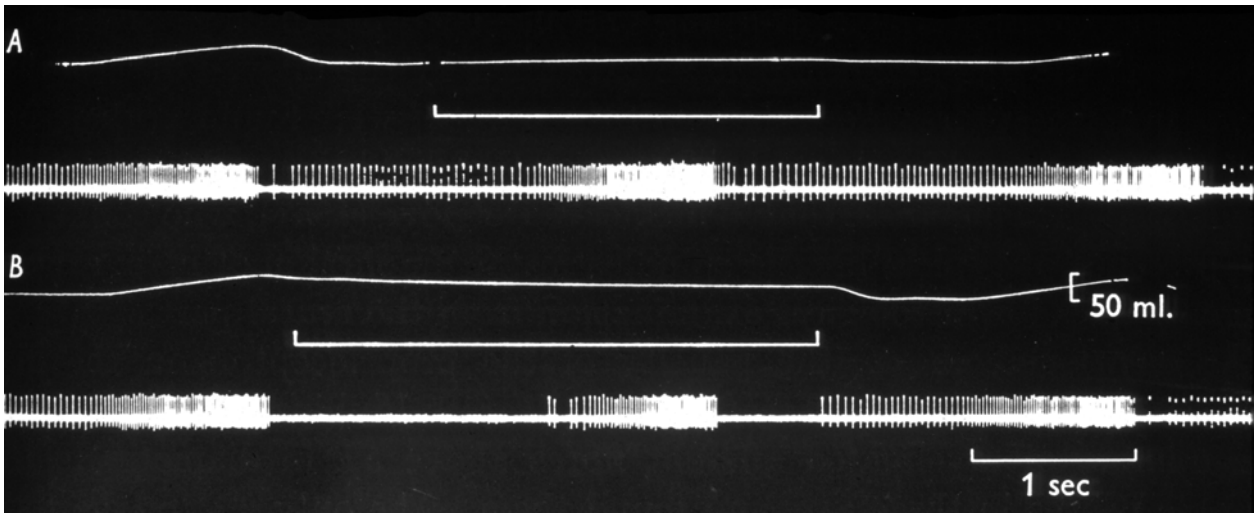


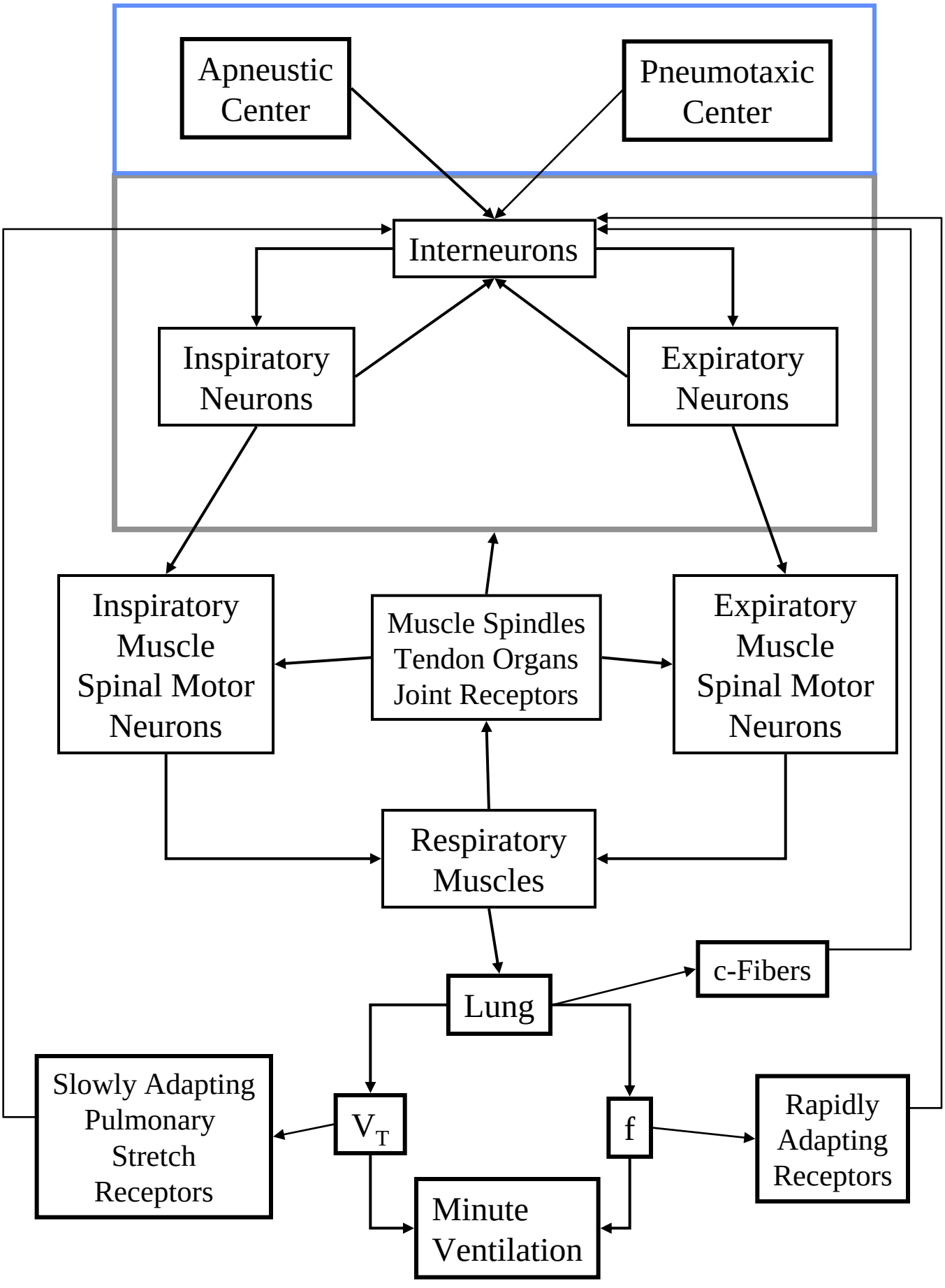
Fig. 2. Comparison of the latencies of response of two types of C-fibre ending to right atrial injection of capsaicin. A, impulses recorded from a right vagal slip containing a 'pulmonary' fibre (small spikes) and a 'bronchial' fibre (large spikes). The chest was closed and the dog was breathing spontaneously: V_T, tidal volume; other abbreviations as in fig. 1. Capsaicin 10 μg/kg was injected into the right atrium at the signal. Note that firing in the 'pulmonary' fibre coincided approximately with the onset of reflex effects (bradycardia, hypotension and apnoea); note also the different patterns of response of the two endings. Both endings were finally located in the right lung. B, histogram showing the latencies of response of 50 afferent vagal C-fibres of lung origin to right atrial injection of capsaicin (10 μg/kg): 28 were 'pulmonary' endings ('p') and 22 were 'bronchial' endings ('b').


Apneustic Center
Pneumotaxic Center
Interneurons
Inspiratory Neurons
Expiratory Neurons
Inspiratory Muscle Spinal Motor Neurons
Expiratory Muscle Spinal Motor Neurons
Respiratory Muscles
Lung
c-Fibers
Slowly Adapting Pulmonary Stretch Receptors
V_T
f
Rapidly Adapting Receptors
Minute Ventilation

Respiratory Muscle Afferents

1. Muscle Spindles
2. Tendon Organs
3. Joint Receptors


A
B
50 ml.
1 sec


Apneustic Center
Pneumotaxic Center
Interneurons
Inspiratory Neurons
Expiratory Neurons
Inspiratory Muscle Spinal Motor Neurons
Muscle Spindles Tendon Organs Joint Receptors
Expiratory Muscle Spinal Motor Neurons
Respiratory Muscles
c-Fibers
Lung
Slowly Adapting Pulmonary Stretch Receptors
V_T
f
Rapidly Adapting Receptors
Minute Ventilation