MECHANICAL AND CHEMICAL CHARACTERISTICS

- UNLIKE ANY OTHER TYPES OF MUSCLE, unitary smooth muscle will respond by contraction to being stretched.
- Stretch is followed by a decline in membrane potential, by an increased frequency of spikes, and by increased tone.

ADRENALINE and NORADRENALINE serve to relax intestinal smooth muscle.

ACETYLCHOLINE serves to cause contractions; this happens because the muscarinic receptors activate Phospholipase C, which in turn produces inositol triphosphate (IP₃) and allows calcium release via inositol triphosphate receptors.

MULTIUNIT SMOOTH MUSCLE is the reverse: Noradrenaline tends to activate it, causing it to contract- even a small amount will result in something like an irregular tetanus, rather than a single twitch. A single twitch for multiunit smooth muscle is very similar to that of skeletal muscle, but it lasts about 10 times as long.

Relaxation

“Endothelial-Derived Relaxation Factor”, EDRF, turned out to be nitric oxide (NO).
- It is a simple molecule which diffuses freely out of the endothelial cells into the smooth muscle of the blood vessels.
- Once inside, it activates soluble guanylate cyclase, which “cylifies” guanosine monophosphate, turning it into cyclic GMP.
- The cGMP then goes on to activate a whole lot of cGMP-sensitive enzymes which have the net effect of relaxing this vascular smooth muscle.

Innervation of smooth muscle

- Unitary smooth muscle has dual innervations, from the sympathetic and the parasympathetic nervous systems, and it responds to both locally released synaptic mediators and to circulating autonomic hormones.
- THE FUNCTION OF THE NERVE SUPPLY IS NOT TO INITIATE MUSCLE ACTIVITY BUT TO MODIFY IT.

FORCE GENERATION AND PLASTICITY OF SMOOTH MUSCLE

- Smooth muscle is insanely efficient; in comparison with skeletal muscle, it contains 20% of the myosin, and has almost 100 times less ATPase activity- but the force it produces is approximately the same, per crosssectional area.
- The tradeoff is the velocity of contraction - the smooth muscle is much slower.
- THERE IS NO RESTING LENGTH: if you stretch a length of smooth muscle, it will increase its tension, and then gradually relax into the new length. So its impossible to correlate length and tension. In this sense, the smooth muscle behaves as a viscous mass, and so this feature is called PLASTICITY.

References: Ganong Review of Medical physiology, 23rd ed, chapter 5.