[0011] Another objective is to provide, systems, devices, and methods for interfacing with the tissues of the wall of a lumen as well as tissues exterior to the lumen, via intra lumen access (e.g. via minimally invasive procedure, via catheter access, etc.).

[0012] The above objectives are wholly or partially met by devices, systems, and methods according to the appended claims in accordance with the present disclosure. Features and aspects are set forth in the appended claims, in the following description, and in the annexed drawings in accordance with the present disclosure.

[0013] According to a first aspect there is provided, a microsurgical tool for monitoring and/or altering electrophysiological activity within the vicinity of a lumen within a body, the microsurgical tool including an elongate member with a distal tip and a control end, the distal tip thereof shaped and dimensioned so as to fit within the lumen, the elongate member shaped and dimensioned so as to extend from an entry site on the body into the lumen; and one or more probes configured with a tip, the probes deployably coupled with the distal tip of the elongate member, electrically, mechanically, and/or fluidly coupled to the control end of the elongate member, the tip of the probe shaped so as to penetrate into and/or through a wall of the lumen upon deployment from the elongate member, one or more of the probes including one or more electrodes, electrically coupled to the probe, one or more of the electrodes configured to convey a signal associated with and/or to alter the electrophysiological activity upon deployment; wherein the microsurgical tool is configured: to record one or more electrophysiological signals from electrophysiological activity in the vicinity of the electrode; and to cancel one or more movement artifacts from the recordings.

[0014] In aspects, the electrophysiological signals may be related to and/or correspond to one or more of water concentration, tissue tone, evoked potential, remotely stimulated nervous activity, sympathetic nervous activity, an electromyographic signal [EMG], a mechanomyographic signal [MMG], a local field potential, an electroacoustic event, vasodialation, vessel wall stiffness, muscle sympathetic nerve activity [MSNA], central sympathetic drive, nerve traffic, combinations thereof, or the like.

[0015] In aspects, a microsurgical tool in accordance with the present disclosure may include a microcircuit, electrically coupled to one or more of the electrodes, the

microcircuit configured to condition the conveyed signal. In aspects, the microcircuit may be embedded within the elongate member. In aspects, the microcircuit is embedded

components of the microsurgical tool, to use one or more of the electrophysiological signals to exclude the anatomical site from a surgical procedure, or the like.

[0033] According to aspects there is provided, a method for evaluating sympathetic tone of a subject including, inserting a microsurgical tool in accordance with the present disclosure into the subject within the vicinity of a target organ or vessel via a lumen, deploying one or more probes into the wall of the lumen, recording the electrophysiological signals conveyed by one or more of the probes included in the microsurgical tool; and generating a metric relating to sympathetic tone from the recorded signals.

[0034] In aspects, a method in accordance with the present disclosure may include monitoring another physiological parameter remotely from the target organ or vessel to generate a corrective signal and using the corrective signal to remove movement artifacts from the electrophysiological signals.

[0035] In aspects, the method may include stimulating one or more anatomical sites in the subject during the recording, and/or diagnosing a medical condition based at least in part upon the metric.

[0036] According to a second aspects there is provided, a method for monitoring and/or altering electrophysiological activity in the vicinity of a vessel, including penetrating an electrode into and/or through a wall of the vessel from within; ~~and~~ recording one or more electrophysiological signals from the activity in the vicinity of the electrode; and cancelling one or more movement artifacts from the recordings.

[0037] In aspects, a method in accordance with the present disclosure may include recording one or more of an evoked potential, remote stimulation of nervous activity, an electromyographic signal [EMG], a mechanomyographic signal [MMG], a local field potential, an electroacoustic event, vasodialation, vessel wall stiffness, muscle sympathetic nerve activity [MSNA], central sympathetic drive, tissue tone, nerve traffic, or combinations thereof in the vicinity of the electrode.

[0038] In aspects, the method may include electrically isolating the electrode from the lumen of the vessel, steering the trajectory of the electrode during the step of

penetration (in aspects, the steering may be dependent upon the recording), depth of the penetration into the wall of the lumen is dependent upon the recording, and recording

electrophysiological activity from a plurality of electrodes~~,~~. As shown in the second aspect, the method includes cancelling one or more movement artifacts from the recordings~~,~~. In aspects, the method may further include delivering a substance to the vicinity of the vessel and recording the effect of the substance on the electrophysiological activity, and/or stimulating and/or ablating a tissue in the vicinity of the vessel and recording the effect of the stimulation and/or ablation on the electrophysiological activity.

[0039] In aspects, the method may include recording a first electrophysiological activity level, applying energy and/or a substance within the vicinity of the vessel and/or through the vessel wall, then recording a second electrophysiological activity level, and comparing the first and second activity levels to determine if the energy and/or substance application had a significant effect on activity, or if further energy and/or substance should be applied.

[0040] In aspects, the method may include determining if sufficient energy has been applied to the treatment site based on the comparison, evaluating the first activity level to determine a suitable treatment site in the vicinity of the organ or vessel, mapping electrophysiological activity in the vicinity of the organ or vessel using the first activity level, applying a stimulus in the vicinity of the organ or vessel, and/or recording electrophysiological activity before, during, and/or after the stimulus.

[0041] In aspects, the method may include recording electrophysiological activity in a proximal region and a distal region measured along the length of the organ or vessel as spaced with respect to an energy and/or substance delivery site, to determine if the energy application affected the electrophysiological activity in the vicinity of the delivery site, determining if the energy application was sufficient to form a neural block using the comparison, and/or applying sufficient energy to the treatment site to form a temporary block and assessing if the change in electrophysiological activity is desirable, if so, applying sufficient energy to the treatment site so as to form a substantially irreversible block. In aspects, the energy is in the form of a radio frequency current, an ultrasonic wave, or thermal energy.

[0042] In aspects, one or more of steps of a method in accordance with the present disclosure may be performed using a microsurgical tool in accordance with the present disclosure.

WHAT IS CLAIMED IS:

1. A microsurgical tool for monitoring and/or altering electrophysiological activity within the vicinity of a lumen within a body, the microsurgical tool comprising:

an elongate member with a distal tip and a control end, the distal tip thereof shaped and dimensioned so as to fit within the lumen, the elongate member shaped and dimensioned so as to extend from an entry site on the body into the lumen; and

one or more probes configured with a tip, the probes deploy-ably coupled with the distal tip of the elongate member, electrically, mechanically, and/or fluidly coupled to the control end of the elongate member, the tip of the probe shaped so as to penetrate into and/or through a wall of the lumen upon deployment from the elongate member, one or more of the probes comprising one or more electrodes electrically coupled to the probe, one or more of the electrodes configured to convey a signal associated withand/or to alter the electrophysiological activity upon deployment;

wherein the microsurgical tool is configured:

to record one or more electrophysiological signals from electrophysiological activity in the vicinity of the electrode; and

to cancel one or more movement artifacts from the recordings.

2. The microsurgical tool in accordance with claim 1, wherein the electrophysiological signals are related to one or more of water concentration, tissue tone, evoked potential, remotely stimulated nervous activity, sympathetic nervous activity, an electromyographic signal [EMG], a mechanomyographic signal [MMG], a local field potential, an electroacoustic event, vasodilation, vessel wall stiffness, muscle

sympathetic nerve activity [MSNA], central sympathetic drive, nerve traffic, or combinations thereof.

sympathetic nerve activity [MSNA], central sympathetic drive, nerve traffic, or combinations thereof.

3. The microsurgical tool in accordance with claim 1 or 2, wherein the electrode is electrically coupled with a microcircuit, the microcircuit configured to condition the conveyed signal, the microcircuit being ~~3.~~ embedded into the microsurgical tool and at least a portion of the electrical coupling is provided via the elongate member.

4. The microsurgical tool in accordance with any preceding claim, wherein one or more of the probes comprises a microelectrode configured to interface with an adjacent tissue volume within or beyond the wall of the lumen, the microelectrode having an area of less than 5000 μm^2, less than 1000 μm^2, less than 250 μm^2, or less than 100 μm^2.

5. The microsurgical tool in accordance with any preceding claim, further comprising one or more stimulating electrodes electrically and mechanically coupled to one or more of the probes and/or the elongate member, the stimulating electrodes configured to provide a stimulating current and/or an ablating current to a tissue site in the vicinity of the wall of the lumen.

6. The microsurgical tool in accordance with claim 5, further comprising a plurality of stimulating electrodes, the microsurgical tool configured to coordinate stimulating currents and/or ablating currents between two or more of the stimulating electrodes, the currents passing through the tissue site.

7. The microsurgical tool in accordance with any preceding claim, wherein one or more of the probes comprises a channel, fluidly coupled with the control end

of the elongate member, the tool configured to deliver a diagnostic substance and/or a

13. The microsurgical tool in accordance with claim 12, wherein the restraining matrix is at least partially biodegradable.

14. The microsurgical tool in accordance with any preceding claim, wherein one or more of the probes is slidingly coupled to the elongate member, sliding of the probe along the length of the elongate member providing the deployment thereof.

15. The microsurgical tool in accordance with any preceding claim, comprising a stabilizing member coupled to the elongate member, the stabilizing member being: configured to retain the position of the distal tip of the elongate member within the lumen upon deployment; selected from a balloon, a basket, a plurality of flexible members, a wire cage, an embolic filter, or a combination thereof; and/or comprising ~~15.~~ one or more electrodes, configured to provide a stimulating, and/or ablating current to the wall of the lumen.

16. The microsurgical tool in accordance with any preceding claim, wherein one or more of the probes is shaped with a curved tip, and is slidingly and rotate-ably coupled with the control end of the elongate member, so as to be steerably advanced through the wall of the lumen upon deployment.

17. The microsurgical tool in accordance with any preceding claim, wherein one or more of the probes comprises a stabilizing element positioned at a predetermined distance from the tip thereof, the stabilizing element configured so as to limit the depth which the probe can penetrate into the wall of the lumen upon deployment.

18. The microsurgical tool in accordance with any preceding claim, wherein one or more of the probes comprises a plurality of electrodes, arranged along a length thereof in relation to the tip thereof, the electrodes configured to convey precise signals

pertaining to electrophysiological activity of an adjacent tissue site in the vicinity thereof and/or impedance between the electrodes during deployment.

19. The microsurgical tool in accordance with claim 18, wherein the conveyed signals relate to the proximity of electrophysiologically active tissues in the vicinity of the wall of the lumen in relation to the probe.

20. The microsurgical tool in accordance with any one of claims 1 – 19, wherein one or more of the probes is sized and dimensioned so as to fit within a precapillary arteriole positioned within the wall of the lumen.

~~21.~~

~~22.~~21. A method for monitoring and/or altering electrophysiological activity in the vicinity of a vessel, comprising:

- penetrating an electrode into and/or through a wall of the vessel from within; ~~and~~
- recording one or more electrophysiological signals from the activity in the vicinity of the electrode; and
- cancelling one or more movement artifacts from the recordings.

~~23.~~22. The method in accordance with claim ~~22~~21, comprising recording one or more of an evoked potential, remote stimulation of nervous activity, an electromyographic signal [EMG], a mechanomyographic signal [MMG], a local field potential, an electroacoustic event, vasodialation, vessel wall stiffness, muscle sympathetic nerve activity [MSNA], central sympathetic drive, tissue tone, nerve traffic, or combinations thereof in the vicinity of the electrode.

~~24.~~23. The method in accordance with claim ~~22~~ 21 or ~~23~~22, comprising electrically isolating the electrode from the lumen of the vessel.

~~25.~~24. The method in accordance with any one of claims ~~22~~ 21 – ~~24~~23, comprising recording electrophysiological activity from a plurality of electrodes.

~~26. The method in accordance with any one of claims 22 – 25, comprising cancelling one or more movement artifacts from the recordings.~~

~~27.~~25. The method in accordance with any one of claims ~~22~~ 21 – ~~26~~24, comprising delivering a substance to the vicinity of the vessel and recording the effect of the substance on the electrophysiological activity.

~~28.~~26. The method in accordance with any one of claims ~~22~~ 21 – ~~27~~25, comprising recording a first electrophysiological activity level, applying energy and/or a substance within the vicinity of the vessel and/or through the vessel wall, then recording a second electrophysiological activity level, and comparing the first and second activity levels to determine if the energy and/or substance application had a significant effect on activity, or if further energy and/or substance should be applied.

~~29.~~27. The method in accordance with claim ~~28~~26, comprising determining if sufficient energy has been applied to the treatment site based on the comparison.

~~30.~~28. The method in accordance with claim ~~28~~ 26 or ~~29~~27, comprising mapping electrophysiological activity in the vicinity of the organ or vessel using the first activity level.

~~31.~~29. The method in accordance with any one of claims ~~28~~ 26 – ~~30~~28, comprising determining if the energy application was sufficient to form a neural block using the comparison.

~~32.~~30. The method in accordance with claim ~~31~~29, comprising applying sufficient energy to the treatment site to form a temporary block and assessing if the change in electrophysiological activity is desirable, if so, applying sufficient energy to the treatment site so as to form a substantially irreversible block.

~~33.~~31. The method in accordance with any one of claims ~~28~~26 – ~~32~~30 wherein the energy is in the form of a radio frequency current, an ultrasonic wave, or thermal energy.