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Specimen holder with wireless transponder for attachment to specimen collection body

Abstract

A specimen holder includes a body, a sleeve, and a wireless transponder. The body has distal and proximal portions, the distal portion including a surface that carries a specimen upon engagement of the body with the specimen, and the proximal portion including a first pair of parallel surfaces. The sleeve has distal and proximal portions, a side wall, and an internal cavity at least partially enclosed by the side wall. The distal portion of the sleeve includes a second pair of parallel surfaces. The wireless transponder is sized to be positioned within the internal cavity of the sleeve. The sleeve is attachable to the body by capturing one of the first and second pairs of parallel surfaces between the other of the first and second pairs of parallel surfaces.

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Background/Summary

BACKGROUND
Technical Field
(1) The present disclosure relates generally to systems and methods of specimen collection, and specifically to a wireless transponder attachable to a specimen holder used to collect and store biological specimen and facilitate identification of stored biological specimen, for example during an IVF procedure.
Description of the Related Art
(2) Long-term preservation of cells and tissues through cryopreservation has broad impacts in multiple fields including tissue engineering, fertility and reproductive medicine, regenerative medicine, stem cells, blood banking, animal strain preservation, clinical sample storage, transplantation medicine, and in vitro drug testing. This can include the process of vitrification in which a biological sample (e.g., an oocyte, an embryo, a biopsy) contained in or on a storage device (e.g., a cryopreservation straw, cryopreservation tube, stick or spatula) is rapidly cooled by placing the biological sample and the storage device in a substance, such as liquid nitrogen. This results in a glass-like solidification or glassy state of the biological sample (e.g., a glass structure at the molecular level), which maintains the absence of intracellular and extracellular ice (e.g., reducing cell damage and/or death) and, upon thawing, improves post-thaw cell viability. To ensure viability, the vitrified biological samples are then typically continuously stored in a liquid nitrogen dewar or other container, which is at a temperature conducive to cryopreservation, for example negative 196 degrees Celsius.
(3) There are, however, a number of concerns in how these biological samples are being stored, identified, managed, inventoried, retrieved, etc.
(4) For example, each harvested embryo is loaded on a rigid embryo straw, tube, stick or spatula. The tube may be open at one end that receives the harvested embryo and closed (e.g., plugged) at the other end. The cryopreservation storage devices containing or holding the embryos are cooled as quickly as possible by plunging the cryopreservation storage device with the biological material into liquid nitrogen at a temperature of approximately negative 196 degrees Celsius, for example to achieve vitrification.
(5) More particularly, multiple cryopreservation storage devices are placed in a goblet for

placement in the liquid nitrogen storage tank. The goblet attaches to the liquid nitrogen storage tank such that the multiple cryopreservation storage devices are suspended in the liquid nitrogen. Labels that are manually written-on using a suitable marker pen or printed using a custom printer are attached to the straw and/or the goblet. Such labels can include identification information corresponding to the individual that the embryo was harvested from and other suitable information (e.g., a cryopreservation storage device number, a practitioner number, etc.).

(6) Stored biological samples can be identified by writing on the storage devices themselves, or by labels stuck to the storage devices. These labels may be handwritten or printed and can include bar codes. However, such methods of identification have associated disadvantages. Written notes on containers can be erased or smudged and labels can fall off the storage devices while they are stored inside the dewar leading to unidentifiable samples. These problems are exacerbated by the cold conditions in which biological samples are kept.

(7) When performing an audit of biological samples stored in cold storage (typically at temperatures of negative 196 degrees Celsius), warming of the samples to a temperature greater than negative 130 degrees Celsius is to be avoided. It is therefore desirable to minimize the amount of time spent outside of the dewar wherever possible.

(8) Recording, monitoring and auditing of samples in cold storage takes a considerable amount of time and effort, even when samples are labelled using barcodes. An additional and undesirable increase in the time taken to record or audit samples arises as a result of frost which can form on the surfaces of the storage devices and their labels when they are removed from liquid nitrogen into relatively warmer temperatures. A layer of frost blocks optical observance of the identification information, and the layer of frost also diffracts the light of a bar code reader. The container cannot be warmed up to remove frost as this would lead to destruction of the sample. The frost can be wiped off the disposable container but this contributes to an undesirable increase in the amount of time taken to read the sample.

(9) Accordingly, it is desirable to provide a new apparatus for collecting, preserving, and identifying biological samples (e.g., vitrified biological samples) at suitably cold temperatures.

BRIEF SUMMARY

(10) According to one aspect of the disclosure, a specimen holder includes a body, a sleeve, and a wireless transponder. The body is elongated along a body longitudinal axis, and the body has distal and proximal ends. The proximal end is opposite the distal end with respect to the longitudinal axis, and the body includes both a distal portion that includes the distal end and a proximal portion that includes proximal end. The distal portion further includes a surface that carries a specimen upon engagement of the body with the specimen, and the proximal portion includes a first body surface and a second body surface that are each angularly offset with respect to the longitudinal axis.

(11) The sleeve is elongated along a sleeve longitudinal axis and includes first and second sleeve surfaces. The first sleeve surface is complimentary to the first body surface and the second sleeve surface is complimentary to the second body surface. The sleeve is attachable to the body such that the first sleeve surface and the first body surface face toward one another and the second sleeve surface and the second body surface face toward one another. The wireless transponder is attached to the sleeve.

(12) A respective one of the body or the sleeve carries a moveable member that includes: the first body surface; the second body surface; both the first body surface and the second body surface; the first sleeve surface; the second sleeve surface; or both the first sleeve surface and the second sleeve surface. The moveable member is movable relative to the respective one of the body or the sleeve such that the surface or surfaces carried by moveable member are moveable toward and away from the respective one of the body longitudinal axis or the sleeve longitudinal axis.

(13) According to another aspect of the disclosure, a method of assembling a specimen holder includes attaching a wireless transponder to a sleeve, and attaching a distal portion of the sleeve to a proximal portion of a body. The body is elongated along a body longitudinal axis, the proximal

portion of the body is opposite a distal portion of the body with respect to the body longitudinal axis, and the distal portion of the body includes a specimen retention surface. The method further includes moving at least one of the sleeve and the body relative to the other of the sleeve and the body in a first direction that is parallel to the body longitudinal axis. While moving at least one of the sleeve and the body relative to the other of the sleeve and the body, the method further includes: moving a first surface carried by a movable member away from the body longitudinal axis, and moving the first surface carried by the movable member toward the body longitudinal axis.

(14) After moving at least one of the sleeve and the body relative to the other of the sleeve and the body, the method further includes aligning the first surface with a second surface thereby blocking movement of the sleeve relative to the body along one direction parallel to the body longitudinal axis. The method further includes aligning a third surface with a fourth surface thereby blocking movement of the sleeve relative to the body along the other direction parallel to the body longitudinal axis. One of the body and the sleeve carries the movable member and the other of the body and the sleeve includes the second surface. The one of the body and the sleeve includes the third surface, and the other of the body and the sleeve includes the fourth surface.

(15) According to another aspect of the disclosure a structure for attachment to a specimen collection body includes a sleeve and a wireless transponder. The sleeve has a snap fit portion at one end thereof that is sized to snap fit to a complimentary snap fit structure on an end of the specimen collection body. The wireless transponder is attached to the sleeve, and the wireless transponder includes at least one antenna and a microchip communicatively coupled to the at least one antenna.

Description

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

(1) In the drawings, identical reference numbers identify similar elements or acts. The sizes and relative positions of elements in the drawings are not necessarily drawn to scale. For example, the shapes of various elements and angles are not necessarily drawn to scale, and some of these elements may be arbitrarily enlarged and positioned to improve drawing legibility. Further, the particular shapes of the elements as drawn, are not necessarily intended to convey any information regarding the actual shape of the particular elements, and may have been solely selected for ease of recognition in the drawings.

(2) FIG. **1** is a top, plan view of a specimen holder, according to one embodiment.

(3) FIG. **2** is a side, elevation view of the specimen holder illustrated in FIG. **1**.

(4) FIG. **3** is a front, elevation view of the specimen holder illustrated in FIG. **1**.

(5) FIG. **4** is a rear, elevation view of the specimen holder illustrated in FIG. **1**.

(6) FIG. **5** is an exploded, side, elevation view of the specimen holder illustrated in FIG. **1**.

(7) FIG. **6** is a side elevation view of a wireless transponder of the specimen holder, according to one embodiment.

(8) FIG. **7** is a side, elevation view of a container according to one embodiment, the container enclosing the specimen holder illustrated in FIG. **1**.

(9) FIG. **8** is an exploded, side, elevation view of the container and the specimen holder illustrated in FIG. **7**.

(10) FIG. **9** is a rear, elevation view of a vial of the container illustrated in FIG. **7**.

(11) FIG. **10** is a front, elevation view of a cap of the container illustrated in FIG. **7**.

(12) FIG. **11** is a side, elevation view of a body of the specimen holder illustrated in FIG. **1**, according to one embodiment.

(13) FIG. **12** is a rear, elevation view of the body illustrated in FIG. **11**.

(14) FIG. **13** is a cross-sectional, side view of a portion of the body illustrated in FIG. **11** identified

by callout B, along line B-B.
(15) FIG. **14** is a top, plan view of a portion of the body illustrated in FIG. **11** identified by callout B.
(16) FIG. **15** is a side, elevation view of a sleeve of the specimen holder illustrated in FIG. **1**, according to one embodiment.
(17) FIG. **16** is a rear, elevation view of the sleeve illustrated in FIG. **15**.
(18) FIG. **17** is a cross-sectional, side, elevation view of the sleeve illustrated in FIG. **15**, along line C-C.
(19) FIG. **18** is a side, elevation view of a cap of the specimen holder illustrated in FIG. **1**, according to one embodiment.
(20) FIG. **19** is a rear, elevation view of the cap illustrated in FIG. **18**.
(21) FIG. **20** is a cross-sectional, side, view of the cap illustrated in FIG. **18**, along line D-D.
(22) FIG. **21** is a front, elevation view of the cap illustrated in FIG. **18**.
(23) FIG. **22** is a cross-sectional, side view of a portion of the specimen holder illustrated in FIG. **1**, along line A-A, during one stage of assembly, according to one embodiment.
(24) FIG. **23** is a cross-sectional, side view of the portion of the specimen holder illustrated in FIG. **22**, along line A-A, during another stage of assembly, according to one embodiment.
(25) FIG. **24** is a cross-sectional, side view of a portion of the specimen holder illustrated in FIG. **1**, along line A-A according to another embodiment.
(26) FIG. **25** is a cross-sectional, side view of a portion of the specimen holder illustrated in FIG. **1**, along line A-A according to another embodiment.
(27) FIG. **26** is a cross-sectional, side view of a portion of the specimen holder illustrated in FIG. **1**, along line A-A according to another embodiment.
(28) FIG. **27** is a cross-sectional, side view of a portion of the specimen holder illustrated in FIG. **1**, along line A-A according to another embodiment.
(29) FIG. **28** is a cross-sectional, side view of a portion of the specimen holder illustrated in FIG. **1**, along line A-A according to another embodiment.

DETAILED DESCRIPTION

(30) In the following description, certain specific details are set forth in order to provide a thorough understanding of various disclosed embodiments. However, one skilled in the relevant art will recognize that embodiments may be practiced without one or more of these specific details, or with other methods, components, materials, etc. In other instances, well-known structures associated with specimen holders have not been shown or described in detail to avoid unnecessarily obscuring descriptions of the embodiments.
(31) Unless the context requires otherwise, throughout the specification and claims which follow, the word “comprise” and variations thereof, such as, “comprises” and “comprising” are to be construed in an open, inclusive sense, that is as “including, but not limited to.”
(32) Reference throughout this specification to “one embodiment,” “an embodiment,” or “an aspect of the disclosure” means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearances of the phrases “in one embodiment” or “in an embodiment” in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.
(33) As used in this specification and the appended claims, the singular forms “a,” “an,” and “the” include plural referents unless the content clearly dictates otherwise. It should also be noted that the term “or” is generally employed in its broadest sense, that is as meaning “and/or” unless the content clearly dictates otherwise.
(34) Reference herein to two elements “facing” or “facing toward” each other indicates that a straight line can be drawn from one of the elements to the other of the elements without contacting an intervening solid structure. Reference herein to two elements being “directly coupled” indicates

that the two elements physically touch with no intervening structure between. Reference herein to a direction includes two components that make up said direction. For example a longitudinal direction, which is bidirectional, includes both a “distal” component (unidirectional) and a “proximal” component (unidirectional), which is opposite the “distal” component. Reference to an element extending along a direction means the element extends along one or both of the components that make up the direction.

(35) The term “aligned” as used herein in reference to two elements along a direction means a straight line that passes through one of the elements and that is parallel to the direction will also pass through the other of the two elements. The term “between” as used herein in reference to a first element being between a second element and a third element with respect to a direction means that the first element is closer to the second element as measured along the direction than the third element is to the second element as measured along the direction. The term “between” includes, but does not require that the first, second, and third elements be aligned along the direction.

(36) Recitation of ranges of values herein are merely intended to serve as a shorthand method of referring individually to each separate value falling within the range including the stated ends of the range, unless otherwise indicated herein, and each separate value is incorporated into the specification as if it were individually recited herein.

(37) Aspects of the disclosure will now be described in detail with reference to the drawings, wherein like reference numbers refer to like elements throughout, unless specified otherwise. Certain terminology is used in the following description for convenience only and is not limiting. The term “plurality”, as used herein, means more than one. The terms “a portion” and “at least a portion” of a structure include the entirety of the structure.

(38) The headings and Abstract of the Disclosure provided herein are for convenience only and do not interpret the scope or meaning of the embodiments.

(39) Referring to FIGS. **1** to **5**, a specimen holder **10** includes a body **12** that carries a specimen **14**, such as a biological materials and/or samples (e.g., eggs, sperm, and zygotes). The body **12** may be in the form of a stick **16** as shown in the illustrated embodiment. According to another embodiment, the body **12** may be in the form of, for example, a spatula, a straw, or a tube. The body **12** may be a monolithic structure, according to one embodiment.

(40) The body **12** may be elongated along a direction, for example a longitudinal direction L, as shown in the illustrated embodiment. The body **12**, may include a distal end **18** and a proximal end **20**. As shown in the illustrated embodiment, the proximal end **20** may be opposite the distal end **18** with respect to the longitudinal direction L. According to one embodiment, the body **12** may extend in a distal component D of the longitudinal direction L from the proximal end **20** and terminate at the distal end **18**, and the body **12** may extend in a proximal component P of the longitudinal direction L, opposite the distal component D, from the distal end **18** and terminate at the proximal end **20**.

(41) The distal end **18** may include a surface that faces in the distal component D, as shown in the illustrated embodiment. The proximal end **20** may include a surface that faces in the proximal component P, as shown in the illustrated embodiment. The body **12** has a length L**1** measured from one of the distal end **18** and the proximal end **20** to the other of the distal end **18** and the proximal end **20** along the longitudinal direction L.

(42) The body **12** may include an outer surface **22** that extends from the distal end **18** to the proximal end **20**. According to one embodiment, the outer surface **22** includes any surface of the body **12** that does not face toward any other surface of the body **12**. The body **12** may include a distal portion **24** and a proximal portion **25**. As shown, the distal portion **24** may carry the specimen **14** upon engagement of the body **12** with the specimen **14**. The distal portion **24** may be positioned closer to the distal end **18** than the proximal portion **25** is from the distal end **18**. Similarly, the proximal portion **25** may be positioned closer to the proximal end **20** than the distal portion **24** is from the proximal end **20**.

(43) The distal portion **24** may include a specimen surface **26** shaped to retain the specimen **14**, for example against a force of gravity when the body **12** is arranged such that the longitudinal direction L is parallel to the force of gravity. The specimen surface **26** may be substantially planar, as shown in the illustrated embodiment. The specimen surface **26** may be curved, for example concave according to one embodiment. The specimen surface **26** may include texturing, grooves, or both. The specimen surface **26** may be a portion of the outer surface **22**. Alternatively, the specimen surface **26** may be an internal surface, for example in an embodiment in which at least a portion of the body **12** is a tube.
(44) The distal portion **24** may have a non-circular cross-sectional shape within a distal plane P**1** that is normal to the longitudinal direction L and that intersects the distal portion **24**. According to one embodiment, the distal plane P**1** may further intersect the distal end **18**, the specimen surface **26**, or both.
(45) The body **12** may have a width measured from one point on the outer surface **22** to another point on the outer surface **22** that is opposite the one point with respect to a lateral direction A, which is perpendicular to the longitudinal direction L. The width may vary at different locations along the length L**1** of the body **12**. For example, the body **12** may have a minimum width W**1** at the distal portion **24**, for example at the distal end **18**. The body **12** may have a maximum width W**2** at the proximal portion **25**, for example at the proximal end **20**. According to one embodiment, the distal portion **24** may include a constant width along the length of the distal portion **24**. According to another embodiment, the width may taper along the distal portion **24**.
(46) The body **12** may have a thickness measured from one point on the outer surface **22** to another point on the outer surface **22** that is opposite the one point with respect to a transverse direction T, which is perpendicular to both the longitudinal direction L, and the lateral direction A. The thickness may vary at different locations along the length L**1** of the body **12**. For example, the body **12** may have a minimum thickness T**1** at the distal portion **24**, for example at the distal end **18**. The body **12** may have a maximum thickness T**2** at the proximal portion **25**, for example at the proximal end **20**. According to one embodiment, the distal portion **24** may include a constant thickness along the length of the distal portion **24**. According to another embodiment, the thickness may taper along the distal portion **24**.
(47) According to one embodiment, the distal portion **24** may be shaped such that the width of the distal portion **24**, for example the minimum width W**1**, is greater than the thickness of the distal portion **24**, for example the minimum thickness T**1**. According to another embodiment, the distal portion **24** may be shaped such that the width of the distal portion **24**, for example the minimum width W**1**, is equal to or less than the thickness of the distal portion **24**, for example the minimum thickness T**1**. According to one embodiment, the proximal portion **25** may be shaped such that the width of the proximal portion **25**, for example the maximum width W**2**, is greater than the thickness of the proximal portion **25**, for example the maximum thickness T**2**. According to another embodiment, the proximal portion **25** may be shaped such that the width of the proximal portion **25**, for example the maximum width W**2**, is equal to or less than the thickness of the proximal portion **25**, for example the maximum thickness T**2**.
(48) The specimen holder **10** may include a transponder fitting, in the form of, according to one embodiment a sleeve **30**. The sleeve **30** may be attachable to the body **12**, for example the proximal portion **25** of the body **12**. According to one embodiment, the sleeve **30** may be releasably attachable to the body **12** such that once attached, the sleeve **30** and the body **12** are separable without plastic deformation of either of the sleeve **30** and the body **12**. According to one embodiment, the sleeve **30** may be non-releasably attachable to the body **12** such that once attached, the sleeve **30** and the body **12** are not separable without plastic deformation of at least one of the sleeve **30** and the body **12**.
(49) The sleeve **30** includes a sleeve body **32**, and the sleeve body **32** may be elongated along a direction, for example the longitudinal direction L, when attached to the body **12** as shown in the

illustrated embodiment. The sleeve **30** may include a distal end **34** and a proximal end **36**. As shown in the illustrated embodiment, the proximal end **36** may be opposite the distal end **34** with respect to the longitudinal direction L. According to one embodiment, the sleeve body **32** may extend in the distal component D of the longitudinal direction L from the proximal end **36** and terminate at the distal end **34**, and the sleeve body **32** may extend in the proximal component P of the longitudinal direction L from the distal end **34** and terminate at the proximal end **36**. The sleeve body **32** may be transparent or translucent such that objects enclosed within the sleeve **30** are visible through the sleeve body **32**. According to one embodiment the sleeve body **32** may be opaque such that objects enclosed within the sleeve **30** are not visible through the sleeve body **32**. According to one embodiment the sleeve body **32** may include an electrically insulative material.
(50) The distal end **34** may include a surface that faces in the distal component D, as shown in the illustrated embodiment. The proximal end **36** may include a surface that faces in the proximal component P, as shown in the illustrated embodiment. The sleeve body **32** may include an outer surface **38** that extends from the distal end **34** to the proximal end **36**. According to one embodiment, the outer surface **38** includes any surface of the sleeve body **32** that does not face toward any other surface of the sleeve body **32**.
(51) The sleeve body **32** may include a distal portion **40** and a proximal portion **42**. As shown, the distal portion **24** may carry a coupler **44** that engages with a corresponding coupler **28** of the body **12** to attach the sleeve **30** to the body **12**. According to one embodiment, the distal portion **40** may be positioned closer to the body **12** than the proximal portion **42** is from the body **12**, when the sleeve **30** is attached to the body **12**. Similarly, the proximal portion **42** may be positioned farther from the body **12** than the distal portion **40**, when the sleeve **30** is attached to the body **12**.
(52) According to one embodiment, the proximal end **36** may be open (as will be described below), and the specimen holder **10** may include a cap **46** attachable to the proximal portion **40** of the sleeve **30** to close the open proximal end **36**. According to one embodiment, the proximal end **36** may be closed (as will be described below), and the specimen holder **10** may be devoid of the cap **46**.
(53) The specimen holder **10** may include a wireless transponder **50**. The wireless transponder **50** may take a variety of forms. For example, the wireless transponder may be in the form of an active, passive, or battery-assisted radio frequency identification transponders (RFID tags) that employs an integrated circuit to store and return a unique identifier. Active RFID transponders include a dedicated power source (e.g., a chemical battery cell) to power the RFID transponder. Passive RFID transponder do not include a dedicated power source, but rather derive power from an interrogation signal, typically charging a capacitor, which provides sufficient power to provide a return signal (e.g., back scatter signal) with unique identifying information imposed thereof. Battery-assisted RFID transponders generally detect an interrogation signal, but employ a dedicated power source (e.g., chemical battery cell) to primarily power the operations.
(54) Also for example, micro-electro-mechanical systems (MEMS) transponders employ one or typically more mechanical elements which mechanically vibrate or oscillate at respective frequencies to return a unique identifier. These MEMS transponders are mechanically based and typically do not employ integrated circuits, nor do they typically store unique identifiers in memory. The terms “integrated circuit RFID transponder” and “non-MEMS RFID transponder” are used herein to distinguish non-mechanical RFID transponders from mechanical or MEMS based transponders.
(55) The wireless transponder **50**, according to one embodiment, may be able to withstand cold temperatures (e.g., negative 150 degrees Celsius; negative 196 degrees Celsius) and continue to operate. In particular, the wireless transponder **50** is preferably able to withstand multiple instances of temperature cycling between cold temperatures (e.g., negative 150 degrees Celsius; negative 196 degrees Celsius) and relatively warmer temperatures to which the containers may be exposed when removed from a cryogenic cooler or dewar. The wireless transponder **50** may advantageously take

the form of passive wireless transponders, which rely on power from interrogation signals to provide responses, for example via backscattering. MEMS transponders may be particularly suitable for operation at cold temperatures.

(56) Referring to FIG. **6**, the wireless transponder **50** may include a printed circuit board **52** and an antenna **54**. The printed circuit board **52** carrying a transponder circuit **56** (e.g., radio, transmitter, backscatter circuit) communicatively coupled to the antenna **54**. As shown, the antenna **54** may include a rod **58**, (e.g., a ferrite rod) with a coil **60** wound around the rod **58**. The wireless transponder **50** may include a power source **64** (e.g., capacitor, chemical battery).

(57) As shown in FIGS. **1** and **2**, and described in additional detail below, the wireless transponder **50** may be enclosed within the sleeve **30** and thereafter the sleeve **30** may be attached to the body **12**, thereby securing the wireless transponder **50** to the body **12**. According to one embodiment, a potting agent may be used to position and retain the wireless transponder **50** within the sleeve **30**.

(58) Referring to FIGS. **7** to **10**, a specimen collection system **100** may include a container **102** for holding biological samples, the container **102** including a vial **104** and a cap **106**. According to one embodiment the vial **104** may be at least partially covered by an outer jacket **108**, also called an outer sleeve or frame. The cap **106** is sized and shaped to removably close an opening **110** at a first end **112** of the vial **104**. The vial **104** includes the first end **112**, a second end **114**, and a side wall **116** that extends between the first end **112** and the second end **114**. The second end **114** may be opposed from the first end **112** across a length of the vial **104**. The side wall **116** extends between the first end **112** and the second end **114** to delimit an interior of the vial **104** from an exterior thereof.

(59) The vial **104** the second end **114** of the vial **104** may be closed or sealable. The vial **104** may take the form of a tube, which may have a circular profile or cross section, or alternatively may have other shapes (e.g., rectangular, hexagonal, octagonal). The opening **110** of the vial **104** may, for example, be circular as shown, although the opening **110** may have other shapes. The second end **114** of the vial **104** may, for example, terminate in a semi-spherical tip or may be frustoconical, terminating in a flat surface **118** which is perpendicular to a longitudinal axis **120** of the vial **104**.

(60) The specimen holder **10** may extend from the cap **106** as an integral, permanently fixed, or removably-attached element, according to at least one implementation. According to one embodiment, the specimen holder **10** may extend from a bottom surface **122**, i.e., an interior-facing surface, of the cap **106**. The specimen holder **10** may be fixed to bottom surface **122** of the cap **106**, according to at least one embodiment. The specimen holder **10** may be fixed to the bottom surface **122** of the cap **106** in any of a variety of ways. For example, the specimen holder **10** may be interference or friction fitted in an aperture **124** in the bottom surface **122** of the cap **106**. Also for example, the specimen holder **10** may be adhered to the bottom surface **122** of the cap **106**.

(61) The cap **106** may have a top portion **126** and a side wall **128** extending from the top portion **126**, the side wall **128** delimiting a portion of the cap **106** which is smaller in extent relative to the top portion **126** in a direction perpendicular to the longitudinal axis **120** of the vial **104** so that the side wall **128** can be inserted into the interior of the vial **104**, the top portion **126** acting as a stopper to limit the depth of insertion of the side wall **128** into the vial **104**. The cap **106** may have threads **130**, for example on an outer surface of the side wall **128** to mate with corresponding threads **132** on an inner surface of the side wall **116** of the vial **104**.

(62) Implementations may advantageously include a number of ports and/or vents **134**. The ports advantageously allow ingress of liquid (e.g., liquid nitrogen) into an interior of the vial **104** while the cap **106** is in place on the vial **104**, while the vents allow gas (e.g., air) to escape from the interior of the vial **104** as liquid enters the vial **104** while the cap **106** is in place on the vial **104**. The ports may be located in the vial **104**, in the cap **106**, or in both the vial **104** and the cap **106**.

(63) According to one embodiment, the vents **134** are located toward the top (e.g., in the cap **106** or at least proximate a portion of the vial **104** closest to the cap **106**), while the ports **134** are positioned toward the bottom (e.g., at least proximate the bottom of the vial **104**), which allows

liquid to leach in from the bottom of the container **100** and gas to vent out from the top as the container **100** is lowered into a cryogenic bath, e.g., in a dewar.
(64) Although the term “vent” has been used herein to describe through-holes (which are not necessarily round), which allow gas (e.g., air) to escape the vial **104** and the term “port” has been used to describe through-holes which allow liquid nitrogen into the vial **104**, these terms are interchangeable in some cases. For example, the structure of the through-holes used for the vents and ports **134** may be simple apertures and therefore may function primarily as vents or ports **134** depending on their position relative to the top and bottom of the container **100** and depending on operational conditions (e.g., depending on whether a container **100** is being lowered into or raised out of a cryogenic bath).
(65) In some implementations, the ports and vents **134** may include valves, flaps, screens, filters, or other structures, to restrict the flow of gas or liquid to a specific direction vis-à-vis the interior of the vial **104** and this may result in structures which act as dedicated ports or vents **134**. In some cases, the outer jacket **108** may include through-holes **136** that align with one or more of the ports or vents **134** in the vial **104** to facilitate ingress and egress of liquid and/or air.
(66) The cap **106** may be formed of any of a variety of materials, for example polymers, for instance thermoplastics, such as polypropylene or polyethylene, and/or any other suitable material that withstand temperatures common in cryogenic applications without significant degradation. An outer surface of the top portion **126** of the cap **106** may include a plurality of facets **138** to facilitate gripping when tightening or loosening the cap **106**. While the cap **106** is generally illustrated as having a portion thereof securely received within the opening of the vial **104**, in some implementations, the cap **106** may alternatively be sized to receive a portion of the vial **104** within an opening in the cap **106**.
(67) According to one embodiment, the outer jacket **108** is shaped and sized to receive the vial **104** within a top opening of the jacket **108**. Both the vial **104** and the outer jacket **108** may have, for example, a circular cross-section such that the circumference of an exterior surface of the vial **104** is approximately equal to a circumference of an inner surface of the outer jacket **108**. Such a configuration allows for a snug fit between the vial **104** and the outer jacket **108**. According to one embodiment, the second end **114** of the vial **104**, e.g., the frustoconical tip which terminates in a flat surface **118**, may be enclosed within the jacket **108**, as shown. According to another embodiment, the second end **114** of the vial **104**, e.g., the frustoconical tip which terminates in a flat surface **118**, may extend from a bottom opening of the jacket **108**.
(68) The inner surface of the jacket **108** may be attached to the exterior surface of the vial, e.g., friction fitted, heat fitted, and/or via adhesive, in implementations in which the outer jacket **108** is to remain associated with the particular vial throughout the lifecycle of the container **100**. In some implementations, the inner surface of the jacket **108** may be removably attached to the exterior surface of the vial **104** to allow removal and replacement of the outer jacket **108**, e.g., if the outer jacket **108** is to be associated with more than one vial **104** (or vice versa). In such a case, there may be an elastic compression fit and/or a friction fit between the vial **104** and the outer jacket **108**.
(69) In implementations, the inner surface of the jacket **108** and/or the exterior surface of the vial **104** may include deformable protrusions **140** which compress elastically to form a compression fit between the vial **104** and the outer jacket **108**. In implementations, the inner surface of the jacket **108** and/or the exterior surface of the vial **104** may include opposing threads or ridges to secure the vial **104** within the outer jacket **108** (or, in other words, to secure the outer jacket **108** to the vial **104**). In implementations, outer jacket **108** may be manufactured separately from the vial **104** and, for example, retrofitted onto existing vials **104**.
(70) The outer jacket **108** may have openings through which the exterior surface of the vial **104** is visible, thereby allowing the contents of the vial **104** to be seen in implementations in which the vial **104** is transparent or translucent. The through-holes **136** may also function as the openings according to one embodiment. As shown, the through-holes/openings **136** may have longer sides

which run along a direction along the longitudinal axis **120** of the outer jacket **108** and shorter sides which run along a direction perpendicular to the longitudinal axis **120** of the outer jacket **108**, or curve around the circumference of the vial **104**. According to one embodiment, the through-holes **136** are sized and shaped to correspond to the ports or vents **134** and therefore may be too small to provide visibility of the exterior surface of the vial **104**. In such an implementation, the outer jacket **108** may include both the ports or vents **134** and the openings as separate elements.

(71) In implementations, an arrangement of arms **142** may extend from the bottom of the jacket **108** along a longitudinal direction of the outer jacket **108** to support a platform **144**, e.g., a solid, disk-shaped platform, which is oriented in a plane, which is normal to the longitudinal axis of the outer jacket **108**. For example, there may be four of the arms **142** at positions which are 90 degrees apart around the circumference of the outer jacket **108**. The arms **142** and the platform **140** may be positioned and sized so that an inner surface of the platform **140** forms a bottom interior surface of the jacket **108**. The bottom interior surface of the jacket **108** may be in contact with, or nearly in contact with, the bottom portion of the vial **104** when the vial **104** is received in the outer jacket **108**. The platform **140** may be attached to ends of the arms **142** or may be integrally formed with the arms **142**, such as, for example, in a thermoplastic manufacturing process. The outer jacket **108** may include one or more visual markings **146** that facilitate identification of the outer jacket **108**. The visual markings **146** may include letters, numbers, bar codes, QR codes, or any combination thereof.

(72) The container **100** may include one or more of the wireless transponders, such as one or more of the wireless transponders **50** may be carried by the vial **104**, the cap **106**, the outer jacket **108** (e.g., by the platform **144** or a main body of the outer jacket **108** from which the arms **142** extend toward the platform **144**), or any combination thereof.

(73) Referring to FIGS. **11** to **14**, the proximal portion **25** of the body **12** may include the coupler **28**, as shown in the illustrated embodiment. The coupler **28** may include a receiver formed in the proximal portion **25** of the body **12**, as shown, or may include a stem extending from the proximal portion **25**. According to one embodiment, the coupler **28** includes one or more movable members **17** positioned within an internal cavity **66** formed by the proximal portion **25** of the body **12**. The internal cavity **66** may have an opening **68** formed in the proximal end **20**. The internal cavity **66** may extend distally from the opening **68** terminating at a base surface **70**.

(74) As shown in the illustrated embodiment, the movable member **17** may be a resilient member that includes a base **72** that extends from a portion of the proximal portion **25** of the body **12**. The resilient member may also include a tip **74** supported by the base **72**. The tip **74** may be a free end such that the tip **74** is moveable towards and away from a longitudinal, central axis **80** of the body **12**. The tip **74** may include a first surface **76** that faces in the proximal component P and a second surface **78** that faces in the distal component D. According to one embodiment, the first surface **76** may be shaped so as to facilitate movement of a member entering the internal cavity **66** through the opening **68** and toward the base surface **70**, while the second surface is shaped so as to block movement of the member exiting the internal cavity **66** through the opening **68** and moving away from the base surface **70**. According to another embodiment, the movable member **17** may be translatable or rotatable relative to a remainder of the body **12**.

(75) The first surface **76** may be oblique with respect to the longitudinal, central axis **80**. According to one embodiment, the first surface **76** may be angularly offset from the longitudinal, central axis **80** by between 10 degrees and 45 degrees. According to one embodiment, the first surface **76** may be angularly offset from the longitudinal, central axis **80** by 25 degrees. The second surface **78** may be perpendicular to the longitudinal, central axis **80**, or at some other angular offset such that movement of a member out of the internal cavity **66**, as described in further detail below, is blocked or at least hindered.

(76) According to one embodiment, the body **12** may include first and second body surfaces separated by a length L**2** measured along the longitudinal direction L. As shown in the illustrated

embodiment, the first and second body surfaces separated by the length L**2** may include the proximal end **20** and the second surface **78** of the tip **74** of the movable member **17**. According to one embodiment, the first and second body surfaces may both be part of the movable member **17** (e.g., the first surface **76** and the second surface **78**).

(77) The first and second body surfaces, as shown, may each be angularly offset with respect to the longitudinal, central axis **80**. According to one embodiment the first and second body surfaces are parallel. According to one embodiment the first and second sleeve surfaces are nonparallel. According to one embodiment, at least one of the first and second body surfaces is perpendicular to the longitudinal, central axis **80**.

(78) The first and second body surfaces may face away from each other (e.g., the first body surface faces at least partially in the proximal component P of the longitudinal direction L and the second body surface faces at least partially in the distal component D of the longitudinal direction L). According to one embodiment, the first and second body surfaces may face toward each other. The first and second body surfaces may be perpendicular to and face in the respective component of the longitudinal direction L, as shown. According to another embodiment, at least one of the first and second body surfaces may be oblique to and face in the respective component of the longitudinal direction L.

(79) The illustrated embodiment of the body **12** is shown including two movable members **17**, with only one of the movable members **17** called out by the reference numerals to increase the clarity of the drawings. The body **12** may include other numbers of the movable member **17**, for example one, or more than two. The movable members **17** may be evenly spaced radially about the central, longitudinal axis **80** (i.e., as shown), or non-uniformly spaced.

(80) Referring to FIGS. **15** to **17**, the distal portion **40** of the sleeve **30** may include the coupler **44**, as shown in the illustrated embodiment. The coupler **44** may include a stem extending from the distal portion **40** of the sleeve **30**, as shown, or may include a receiver formed in the distal portion **40**. The stem of the receiver may be complementary to the receiver or the stem of the body **12** to mate therewith. According to one embodiment, the coupler **44** is sized to be positioned within the internal cavity **66** of the body **12** (shown in FIG. **13**). The coupler **44** may be in the form of a projection **82** extending from a first surface **83** in the distal component D.

(81) According to one embodiment, the projection **82** may include a base **84**, an intermediate portion **86**, and a tip **88**. The tip **88** may be in the form of a lug extending either radially or laterally outward from a remainder of the projection **82**. The intermediate portion **86** may include an area **90** with a reduced cross-sectional thickness, relative to the tip **88** and the base **84**. According to one embodiment, the tip **88** and the base **84** have equal cross-sectional thicknesses. The intermediate portion **86** may include a first surface **94** that faces in the distal component D and a second surface **96** that faces in the proximal component P.

(82) The first surface **94** may be oblique with respect to the longitudinal, central axis **92**. According to one embodiment, the first surface **94** may be angularly offset from the longitudinal, central axis **92** by between 10 degrees and 45 degrees. According to one embodiment, the first surface **94** may be angularly offset from the longitudinal, central axis **92** by 25 degrees. According to one embodiment, the first surface **94** may be angularly offset from the longitudinal, central axis **92** by the same angle as the first surface **76** is offset from the longitudinal, central axis **80**. The second surface **96** may be perpendicular to the longitudinal, central axis **92**. According to one embodiment, the second surface **96** may be angularly offset from the longitudinal, central axis **92** by the same angle as the second surface **78** is offset from the longitudinal, central axis **80**.

(83) According to one embodiment, the sleeve **30** may include first and second sleeve surfaces separated by a length L**3** measured along the longitudinal direction L. As shown in the illustrated embodiment, the first and second sleeve surfaces separated by the length L**3** may include the first surface **83** and the second surface **96** of the projection **82**. According to one embodiment, the first and second sleeve surfaces may both be part of the projection **82** (e.g., the distal end **34** and the

second surface **96**).
(84) The first and second sleeve surfaces may face toward each other (e.g., the first sleeve surface faces at least partially in the distal component D of the longitudinal direction L and the second sleeve surface faces at least partially in the proximal component P of the longitudinal direction L). According to one embodiment, the first and second sleeve surfaces may face away from each other. The first and second sleeve surfaces may be perpendicular to and face in the respective component of the longitudinal direction L, as shown. According to another embodiment, at least one of the first and second sleeve surfaces may be oblique to and face in the respective component of the longitudinal direction L.
(85) The first and second sleeve surfaces, as shown, may each be angularly offset with respect to the longitudinal, central axis **92**. According to one embodiment the first and second sleeve surfaces are parallel. According to one embodiment the first and second sleeve surfaces are nonparallel. According to one embodiment, at least one of the first and second sleeve surfaces is perpendicular to the longitudinal, central axis **92**. Each of the first and second sleeve surfaces may be complimentary to one of the first and second body surfaces. For example, upon attachment of the body **12** and the sleeve **30**, the first body surface mates with the first sleeve surface and the second body surface mates with the second sleeve surface.
(86) According to one embodiment, the proximal portion **42** of the sleeve **30** may form an internal cavity **200** having an opening **202** formed in the proximal end **36**. As shown in the illustrated embodiment, the internal cavity **200** may extend distally from the opening **202** and terminate at a base surface **204**. The proximal portion **42** may include a second coupler **206** to attach the cap **46** (shown in FIG. **18**) to the sleeve **30**, as described in greater detail below. According to one embodiment, the coupler **206** may include a groove or threads.
(87) The sleeve **30** has a length L**4** measured from one of the distal end **34** and the proximal end **36** to the other of the distal end **34** and the proximal end **36** along the longitudinal direction L. According to one embodiment, the length L**4** of the sleeve **30** is less than the length L**1** of the body **12**. According to one embodiment, the length L**4** of the sleeve **30** is less than 25 percent of the length L**1** of the body **12**. According to one embodiment, the length L**4** of the sleeve **30** is less than 10 percent of the length L**1** of the body **12**.
(88) Referring to FIGS. **11** to **17**, the coupler **28** and the coupler **44** may be reversed, such that the sleeve **30** includes the movable member **17** and the body **12** includes the intermediate portion **86** and the tip **88**.
(89) Referring to FIGS. **18** to **21**, the cap **46** may have a top portion **210** and a side wall **212** extending from the top portion **210**, the side wall **212** delimiting a portion of the cap **46** which is smaller in extent relative to the top portion **210**. The cap **46** may have one or more couplers **214** that includes threads or one or more projections. The coupler **214** may be integral with the side wall **212**, according to one embodiment. The coupler **214** may be a compressible member, or may be spring biased.
(90) Referring to FIGS. **22** to **25**, a structure, for example a kit, for attachment to a specimen collection body, such as the body **12**, may include the sleeve **30** and the wireless transponder. The sleeve **30** may have a snap fit portion, for example the projection **82**, at one end thereof that is sized to snap fit to a complimentary snap fit structure, for example the proximal portion **25** including the movable member **17**, on an end of the specimen collection body. The wireless transponder **50** may be attached to the sleeve **30**. The wireless transponder **50** may include at least one antenna and a microchip communicatively coupled to the at least one antenna. The structure or kit may be used to retrofit an existing specimen collection body, for example so as to turn a “dumb” specimen collection body (devoid of any identification information) into a “smart” specimen collection body.
(91) Referring to FIGS. **11** to **25**, a method of assembling the specimen holder **10** may include attaching the wireless transponder **50** to the sleeve **30**, for example by positioning the wireless transponder **50** within the internal cavity **200** of the sleeve **30**. Positioning the wireless transponder

50 within the internal cavity **200** of the sleeve **30** may include moving the wireless transponder **50** through the opening **202** and toward the base surface **204**. The method may include securing a position of the wireless transponder **50** within the internal cavity **200**, for example by filling the internal cavity **200** and thereby surrounding the wireless transponder **50** with a potting material.
(92) The method may include blocking the opening **202**, for example by attaching the cap **46** to the sleeve **30**. Attaching the cap **46** to the sleeve **30** may include moving the cap **46** in the distal component D with respect to the sleeve **30**, thereby inserting the side wall **212** into the inner cavity **200**, until the coupler **206** of the sleeve **30** engages with the coupler **214** of the cap **46**. Other methods of attaching the cap **46** to the sleeve **30**, such as applying an adhesive, may be employed.
(93) The method may include attaching the sleeve **30** to the body **12**, for example by attaching the distal portion **40** of the sleeve **30** to the proximal portion **25** of the body **12**. According to one embodiment, attaching the sleeve **30** to the body **12** includes moving at least one of the sleeve **30** and the body **12** relative to the other of the sleeve **30** and the body **12** in a first direction that is parallel to the body longitudinal axis **80**, for example moving the coupler **44** through the opening **68**, into the inner cavity **66**, and toward the base surface **70**. Attaching the sleeve **30** to the body **12** includes abutting the tip **88** with one or more of the movable members **17**. While abutting the tip **88** with one or more of the movable members **17**, continued distal movement of the sleeve **30** relative to the body **12** forces the one or more movable members **17** to move, for example flex, away from the longitudinal, central axis **80**, as shown in FIG. **22**.
(94) Upon alignment of the intermediate portion **86** and the tip **74**, the one or more movable members **17** move back, for example via a biasing force inherent in the one or more movable members **17**, toward the longitudinal, central axis **80**, as shown in FIG. **23**. Once the one or more movable members **17** move back toward the longitudinal, central axis **80**, the second surface **78** and the second surface **96** may be aligned with respect to the longitudinal direction L. Movement of the one or more movable members **17** back toward the longitudinal, central axis **80** may result in an audible indication, for example a click or snap, indicating that the sleeve **30** is now attached to the body **12**.
(95) As shown in the illustrated embodiment, the length L**2** between the first and second body surfaces (e.g., the proximal end **20** and the second surface **78**) and the length L**3** between the first and second sleeve surfaces (e.g., the first surface **83** and the second surface **96** of the projection **82**) may correspond. For example the length L**3** may be slightly smaller than the length L**2** such that the first and second body surfaces are able to be captured between the first and second sleeve surfaces. The first and second body surfaces may be captured such that movement of the sleeve **30** relative to the body **12** in a component of the longitudinal direction L is blocked by abutment of one of the first and second body surfaces and one of the first and second sleeve surfaces. As shown, alignment and abutment of the second surface **78** and the second surface **96** blocks movement of the sleeve **30** in the proximal component P relative to the body **12**, and alignment and abutment of the first surface **83** and the proximal end **20** blocks movement of the sleeve **30** in the distal component D relative to the body **12**.
(96) According to one embodiment, the tip **88** may be trapped between the second surface **78** and the base surface **70**, thereby preventing any movement of the sleeve **30** relative to the body **12** in either the proximal component P or the distal component D.
(97) The specimen holder **10**, and method of assembling the specimen holder **10**, as described herein may provide advantages in procedures that include collection of biological samples. For example, the positioning of the sleeve **30** and the enclosed wireless transponder **50** at the proximal end **20** of the body **12** (opposite the portion of the body **12** which retains the specimen **14**) enables the attachment of the wireless transponder **50** after collection of the specimen **14**, without disturbing the specimen **14**. Additionally, the position of the wireless transponder **50** opposite the specimen **14** enables a reader of the wireless transponder **50** to interrogate the wireless transponder **50** without coming into proximity and/or disturbing the specimen **14**.

(98) The snap-fit provided by engagement of the movable member **17** and the projection **82** enables quick attachment of the sleeve **30** (and enclosed wireless transponder **50**) with the body **12** (and collected specimen **14**, if already collected) without the need for tools or additional parts (e.g., fasteners, adhesives, etc.). This may be beneficial in procedures that include specimen **14** that require strict temperature control, for example a specimen **14** which must be vitrified quickly to ensure the specimen **14** remains viable.
(99) Referring to FIG. **24**, attaching the sleeve **30** to the body **12** may include inserting a projection **208** of the body into a recess **210** of the body **12**, the recess **210** having a shape that corresponds to a shape of the projection **208**. As shown, the body **12** and the sleeve **30** may be devoid of the movable member **17**. An adhesive may be applied to one or both of the projection **208** and the recess **210**, for example prior to insertion of the projection **208** into the recess **210**, to secure the sleeve **30** and the body **12**.
(100) Referring to FIG. **25**, the sleeve **30** may be attached to the body **12** without moving the sleeve **30** through the inner cavity **66** toward the base surface. For example, a portion of the sleeve **30**, for example the coupler **44** may be formed, for example injection molded, inside the inner cavity **66**. As shown, the body **12** and the sleeve **30** may be devoid of the movable member **17**.
(101) Referring to FIGS. **26** to **28**, the sleeve **30** the inner cavity **200** may be open to the distal end **34** of the sleeve **30** and closed to the proximal end **36** of the sleeve **30**. As shown in the illustrated embodiment, the specimen holder **10** may be devoid of the cap **64**. After positioning the wireless transponder **50** within the inner cavity **200**, the inner cavity **200** may be closed by securing the distal end **34** of the sleeve **30** to the body **12**, either directly (as shown in FIGS. **26** and **27**) or indirectly, via a spacer **216**, (as shown in FIG. **28**). According to one embodiment, the sleeve **30** may be integral with the body **12**, for example the sleeve **30** may be insert molded into the body **12**.
(102) The above description of illustrated embodiments, including what is described in the Abstract, is not intended to be exhaustive or to limit the embodiments to the precise forms disclosed. Although specific embodiments of and examples are described herein for illustrative purposes, various equivalent modifications can be made without departing from the spirit and scope of the disclosure, as will be recognized by those skilled in the relevant art. These and other changes can be made to the embodiments in light of the above-detailed description.
(103) Many of the methods described herein can be performed with variations. For example, many of the methods may include additional acts, omit some acts, and/or perform acts in a different order than as illustrated or described. The various embodiments described above can be combined to provide further embodiments. All of the commonly assigned US patent application publications, US patent applications, foreign patents, and foreign patent applications referred to in this specification and/or listed in the Application Data Sheet, including but not limited to U.S. patent application Ser. No. 17/547,094, filed Dec. 9, 2021 and U.S. patent application 63/123,959, filed Dec. 10, 2020 are incorporated herein by reference, in its entirety.
(104) In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

Claims

1. A method of assembling a specimen holder, the method comprising: attaching a wireless transponder to a sleeve; attaching a distal portion of the sleeve to a proximal portion of a body, the body elongated along a body longitudinal axis, the proximal portion of the body opposite a distal portion of the body with respect to the body longitudinal axis, wherein the distal portion of the body includes a specimen retention surface; moving at least one of the sleeve and the body relative to the other of the sleeve and the body in a first direction that is parallel to the body longitudinal

axis; moving a first surface carried by a movable member away from the body longitudinal axis while moving at least one of the sleeve and the body relative to the other of the sleeve and the body; moving the first surface carried by the movable member toward the body longitudinal axis while moving at least one of the sleeve and the body relative to the other of the sleeve and the body; aligning the first surface with a second surface thereby blocking movement of the sleeve relative to the body along one direction parallel to the body longitudinal axis after moving at least one of the sleeve and the body relative to the other of the sleeve and the body; aligning a third surface with a fourth surface thereby blocking movement of the sleeve relative to the body along the other direction parallel to the body longitudinal axis; and securing the sleeve to the body such that motion of the sleeve relative to the body parallel to the body longitudinal axis is prevented, wherein one of the body and the sleeve carries the movable member and the other of the body and the sleeve includes the second surface, the one of the body and the sleeve includes the third surface, and the other of the body and the sleeve includes the fourth surface.

2. The method of claim 1 wherein the proximal portion of the body has a first cross-sectional dimension measured in a direction perpendicular to the body longitudinal axis, the distal portion of the body has a second cross-sectional dimension measured in the direction perpendicular to the body longitudinal axis, the first cross-sectional dimension is greater than the second cross-sectional dimension, and attaching the distal portion of the sleeve to the proximal portion of the body includes attaching the distal portion of the sleeve to a portion of the body that has the first cross-sectional dimension.

3. The method of claim 1 wherein the body carries the movable member, and wherein moving at least one of the sleeve and the body relative to the other of the sleeve and the body, further comprises: passing a projection of the sleeve through an opening formed in the proximal portion of the body.

4. The method of claim 1 wherein the sleeve at least partially encloses an internal cavity, and the method further comprises: securing the wireless transponder within the internal cavity, and wherein securing the wireless transponder within the internal cavity includes at least partially filling the internal cavity with a potting material.

5. The method of claim 1, further comprising: after positioning the wireless transponder within the internal cavity, blocking an opening of the internal cavity through which the wireless transponder passed, wherein the opening is formed in a proximal portion of the sleeve, the proximal portion of the sleeve opposite the distal portion of the sleeve along a sleeve longitudinal axis, and the method further comprises abutting a cap with the proximal portion of the sleeve, thereby blocking the opening of the internal cavity.

6. The method of claim 1, further comprising: engaging the distal portion of a body with a specimen such that the specimen is retained on the specimen retention surface of the distal portion of the body.