

DRUG DELIVERY DEVICE WITH OFFSET ACTUATOR MECHANISM

The present disclosure relates to a drug delivery device and in particular to a drug delivery device for oral administration. The drug delivery device is advantageously configured for
5 delivery of an active drug substance in the gastrointestinal tract including the stomach and/or intestines, such as the small intestines and/or the large intestines (colon).

BACKGROUND

A number of for example low permeable and/or low water soluble active drug substances are currently delivered by i.e. subcutaneous, intradermal, intramuscular, rectal, vaginal or
10 intravenous route. Oral administration has the potential for the widest patient acceptance and thus attempts to deliver low permeable and/or low water soluble active drug substances through the preferred oral route of administration has been tried but with limited success in particular due to lack of stability and limited absorption from the gastrointestinal tract.

15 Stability both relates to the stability of the active drug substance during manufacturing and storage of the delivery device, and to the stability of the active drug substance during the passage in the gastrointestinal tract before it become available for absorption.

Limited gastrointestinal absorption is due to the gastrointestinal wall barrier preventing active drug substance from being absorbed after oral dosing because of the low
20 permeability of the active drug substance, which is for example due to pre-systemic metabolism, size and/or the charges and/or because of the water solubility of the active drug substance.

Multiple approaches to solve these stability and absorption challenges have been suggested, but an effective solution to the challenges remain unresolved.

25 SUMMARY

Thus, there is an unmet need to provide a drug delivery device, which is capable of delivering drug substances for absorption in the gastrointestinal tissue. More generally, there remains a need for drug products and methods that enable enhanced drug delivery, when drug products are administered orally to patients.

Disclosed herein are examples of a drug delivery device. The drug delivery device can comprise a central axis. The central axis can extend from a first longitudinal end of the drug delivery device to a second longitudinal end of the drug delivery device. The drug delivery device can comprise a first body part. The drug delivery device can comprise a second body part. The drug delivery device can comprise an attachment part. The attachment part can be connected to the first body part. The drug delivery device can comprise an actuator mechanism. The actuator mechanism can be configured to rotate one of the first body part and the second body part. The actuator mechanism can be located more towards the first longitudinal end than the second longitudinal end along the central axis.

It is an advantage of the present disclosure that the drug delivery device secures stability of the active drug substance during passage in the gastrointestinal tract and facilitates effective absorption of the active drug substance from the gastrointestinal tract after oral administration.

Further, it is advantage of the present disclosure that the drug delivery device provides an active attachment of the drug delivery device to the gastro-internal wall, such as the stomach wall and/or intestine wall. Advantageously, the present disclosure can also allow for a reduced size of a drug delivery device. Further, the present disclosure can allow for improved attachment of the drug delivery device, such as to a gastro-internal wall. For example, differentiating rotation speeds of the first body part and the second body part can allow for improved attachment. Moreover, the offset actuator mechanism can allow for a first attachment part to located closer to an optional second attachment part. This can allow for improved attachment of the drug delivery device as the attachment parts can be positioned better with a short distance between the two attachment part insertion sites.

Further, the present disclosure advantageously provides oral delivery of low permeable active drug substances in or at the gastro-internal tissue.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features and advantages of the present invention will become readily apparent to those skilled in the art by the following detailed description of exemplary embodiments thereof with reference to the attached drawings, in which:

Fig. 1 illustrates a diagram of an example drug delivery device having an offset actuator mechanism according to the disclosure,

Fig. 2 illustrates a diagram of an example drug delivery device having an offset actuator mechanism according to the disclosure, and

- 5 Fig. 3 illustrates a diagram of an example drug delivery device having an offset actuator mechanism according to the disclosure.

DETAILED DESCRIPTION

Various exemplary embodiments and details are described hereinafter, with reference to the figures when relevant. It should be noted that the figures may or may not be drawn to
10 scale and that elements of similar structures or functions are represented by like reference numerals throughout the figures. It should also be noted that the figures are only intended to facilitate the description of the embodiments and the functionalities associated therewith. They are not intended as an exhaustive description of the invention or as a limitation on the scope of the invention or the physical appearance of the
15 invention. In addition, an illustrated embodiment needs not have all the aspects or advantages shown. An aspect or an advantage described in conjunction with a particular embodiment is not necessarily limited to that embodiment and can be practiced in any other embodiments even if not so illustrated, or if not so explicitly described.

A drug delivery device is disclosed. The drug delivery device can include a central axis.
20 The central axis can extend from a first longitudinal end of the drug delivery device to a second longitudinal end of the drug delivery device. The drug delivery device can include a first body part. The drug delivery device can include a second body part. The delivery device can include an attachment part. The attachment part can be connected to the first body part. The delivery device can include an actuator mechanism. The actuator
25 mechanism can be configured to rotate one of the first body part and the second body part. The actuator mechanism can be located more towards the first longitudinal end than the second longitudinal end along the central axis.

As discussed herein, longitudinally may be based on an axis connecting the first longitudinal end and the second longitudinal end. The first longitudinal end and the
30 second longitudinal end may be the farthest spaced ends of the drug delivery device. The first longitudinal end and the second longitudinal end may not be the farthest spaced ends

of the drug delivery device. The first longitudinal end and the second longitudinal end may be on opposite ends of the drug delivery device.

The drug delivery device may have a size and geometry designed to fit into a pharmaceutical composition for oral administration.

- 5 The drug delivery device/pharmaceutical composition may be configured to be taken into the body via the oral orifice. Thus, the outer dimensions of the drug delivery device/pharmaceutical composition may be small enough for a user to swallow. The drug delivery device may be adapted to carry a drug substance into the body of the user, via the digestive system, so that the drug delivery device may e.g. travel from the mouth of
10 the user into the stomach, via the oesophagus. The drug delivery device may further travel into the intestines from the stomach, and may optionally travel into the bowels and out through the rectum.

- The drug delivery device may be configured to deliver the drug in any part of the digestive system of the user, where in one example it may be configured to deliver a drug
15 substance into the stomach of the user. In another example, the drug delivery device may be adapted to initiate the drug delivery when the device has passed the stomach and has entered the intestine of the user. In other words, the drug delivery device may be configured to attach to a wall of the stomach or a wall of the intestines, e.g. depending on the desired release position of the active drug substance.

- 20 The attachment part(s) of the drug delivery device may be configured to interact with the inner surface linings of the gastrointestinal tract, so that the drug delivery device may e.g. be attached to the inner surface (mucous membrane) of the stomach, or alternatively to the mucous membrane of the intestines. The attachment part(s) may be configured to interact with the mucous membranes, e.g. in order to fix or attach the drug delivery
25 device, e.g. for a period of time, inside the body of the user. By attaching the drug delivery device, it will allow a drug substance to be delivered into a part of the digestive system, in order to provide a drug substance to the body of the user. The attachment part(s) may be configured to interact with the mucous membranes, e.g. in order to inject drug substance into the gastrointestinal tract wall.

- 30 The drug delivery device has a central axis optionally extending from a first end to a second end of the drug delivery device. The drug delivery device may have a length (e.g. largest extension from first end to second end along central axis), in the range from 3 mm

to 35 mm, such as in the range from 5 mm to 26 mm. The drug delivery device may be elongated.

The drug delivery device may have a width and/or height (e.g. largest extensions along width axis and height axis, respectively) in the range from 1 mm to 20 mm. Height and
5 width are the largest extensions of the drug delivery device perpendicular to the central axis.

In one or more exemplary drug delivery devices, the dimensions of the drug delivery device, at least in an initial state or first state prior to actuation of the first attachment part and/or the second attachment part, may be represented by a length (largest extension
10 along central axis), a width (largest extension along width axis perpendicular to the central axis) and a height (largest extension along height axis perpendicular to the central axis and the width axis). The height of the drug delivery device may be in the range from 1 mm to 15 mm. The width of the drug delivery device may be in the range from 1 mm to 15 mm.

15 In one or more exemplary drug delivery devices, the drug delivery device may be constructed in a way that secures the drug delivery part to deliver a payload or active drug substance into the internal tissue or internal surface for distribution of the active drug substance in the subject through the blood vessels.

Advantageously, the drug delivery device may be attached, and may deliver the active
20 drug substance, to a particular location in a patient's intestinal wall. Of course, the delivery device may be attached, and may deliver the active drug substance, to other places as well. In one or more exemplary drug delivery devices, the drug delivery device, such as the spike, may penetrate the muscularis mucosa. In one or more exemplary drug delivery devices, the drug delivery device, such as the spike, may not penetrate the muscularis
25 externa. In one or more exemplary drug delivery devices, the spike may be positioned in the submucosa. In one or more exemplary drug delivery devices, the spike may be positioned in the submucosa parallel to the gut wall.

The drug delivery device comprises a first body part. The first body part may be a two-part body part, i.e. the first body part may comprise a first primary body part and a first
30 secondary body part. The first body part has an outer surface. A first primary recess and/or a first secondary recess may be formed in the outer surface of the first body part.

The drug delivery device optionally comprises a shell having a first shell part. An outer surface of the first body part may constitute at least a part of the first shell part.

The drug delivery device can comprise an attachment part. For example, the drug delivery device comprises a first attachment part. Attachment part and first attachment part may be used interchangeable herein. The first attachment part may comprise a first base part and/or a first needle, e.g. a spike. The first attachment part has a first proximal end and a first distal end. The first attachment part, such as the first needle or spike, optionally has or extends along a first attachment axis. A first tip of the first needle forms the first distal end. In other words, the first distal end is a first tip of the first needle. The first base may be arranged at or constitute the first proximal end of the first attachment part. The first needle may have a length in the range from 1 mm to 15 mm such, as in the range from 3 mm to 10 mm. Thereby sufficient penetration into the internal tissue may be provided for while at the same time reducing the risk of damaging the internal tissue. The first distal end of the first attachment part may be provided with a tip configured to penetrate a biological tissue. The first distal end of the first attachment part may be provided with a gripping part configured to grip a biological tissue.

In one or more example drug delivery devices, the attachment part can include a spike. The spike can have a distal tip. The distal tip can be directed non-parallel to the central axis. The distal tip can be directed orthogonal to the central axis. The distal tip can be directed parallel to the central axis.

The distal tip can be directed non-parallel to a longitudinal axis of the drug delivery device. The distal tip can be directed orthogonal to the longitudinal axis of the drug delivery device. The distal tip can be directed parallel to the longitudinal axis of the drug delivery device.

The first needle may have a cross-sectional diameter in the range from 0.1mm to 5mm, such as in the range from 0.5mm to 2.0mm.

The first needle may be straight and/or curved. The first needle may comprise a first primary section that is straight. The first needle may comprise a first secondary section, e.g. between the first primary section and the first distal end or between the first base and the first primary section. The first secondary section may be curved.

The first needle may include two or more straight portions formed at an angle. For example, the first needle may have a proximal portion that extends at a first angle from a connection point to the drug delivery device and a distal portion that extends at a second angle from a connection point to the drug delivery device. The first angle and the second angle may be different. The proximal portion may connect to the distal portion at a joint (e.g., bend, connection, angle) and have a joint angle between the proximal portion and the distal portion. The joint angle may be an acute angle, an obtuse angle, or a right angle. The angle may be, for example, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 130, 140, 150, 160, or 170 degrees. This can advantageously allow for different angles of attach when the first needle interacts with inner surface linings. This may allow for improved attachment of the drug delivery device, while helping to reduce or avoid tissue damage. Further, the joint may be flexible. Alternatively, the joint may not be flexible.

The joint may be located at a center, or generally at a center, of a length of the first needle. Alternatively, the joint may be located 40, 45, 55, 60, or 65% up a length of the first needle from the proximal end.

In one or more exemplary first attachment parts, the first needle may have three, four, or five different portions at different angles, each connected by a joint. In some iterations, any or all of the different portions may be straight or curved. Each joint may be flexible or not flexible.

The attachment parts of the drug delivery device may be seen as any kind of attachment parts that may be capable of attaching the drug delivery device to a biological tissue, such as a stomach wall, a wall of the bowels and/or intestines of a human or animal body. The attachment parts may be adapted to extend in a direction away from the central axis of the drug delivery device, and/or a central axis of the first attachment part. This may mean that the attachment part(s), e.g. at least in an activated state or second state of the drug delivery device, may extend in a direction away from a peripheral surface (in radial direction) of the first body part and/or the second body part, so that the attachment part extends farther in a radial direction than the peripheral or outer surface of the body part.

The first attachment part may be fixed or rotationally attached to the first body part.

In one or more exemplary drug delivery devices, the drug delivery device comprises a second body part. The second body part may be a two-part body part, i.e. the second body part may comprise a second primary body part and a second secondary body part.

The second attachment part is optionally attached to the second body part. The second attachment part may be fixed or rotationally attached to the second body part. The second body part has an outer surface. A second primary recess and/or a second secondary recess may be formed in the outer surface of the second body part. In one or more
5 exemplary drug delivery devices, the actuator mechanism is configured to rotate the first body part in relation to the second body part about a primary axis of the drug delivery device. The primary axis may be parallel to and/or coinciding with the central axis.

In one or more exemplary drug delivery devices, the first body part is configured to rotate in a first direction and/or the second body part is configured to rotate in a second direction
10 opposite to the first direction.

The drug delivery device may comprise a frame part, where different parts, such as the first body part and/or the second body part are attached, e.g. fixed or rotatably attached to the frame part. In one or more exemplary drug delivery devices, the actuator mechanism, or parts thereof, may be attached to the frame part. Thereby, separate rotation of the first
15 body part and the second body part in relation to the frame part may be provided for

The rotational connection between the first body part and the second body part allows the first body part to rotate relative to the second body part, without the two parts separating from each other before the attachment part(s) interact with the internal tissue, such as mucous membranes. Such a connection may be obtained in a plurality of ways, where in
20 one example the first body part has a plug connection and the second body part has a socket connection, where this plug and socket configuration allows the first body part to rotate relative to the second body part. A second example could be to provide an axle that may be coaxial with the central axis and/or the primary axis, where the first body part and the second body part are configured to receive the axle, and a stopping device is
25 arranged at first and second ends of the axle, on each side of the combined first and second body part, preventing the first body part and the second body part to slide in a longitudinal direction along the axle. The axle may be integrated in the first body part or in the second body part.

If an axle were used, the axle can be made of any number of different materials. For
30 example, the axle can be made of metals and/or alloys and/or polymers and/or composites and/or composites and/or combinations thereof.

The first and/or the second body part may be arranged to rotate freely relative to each other, e.g. at least in the second state, and thereby allowing the attachment parts to rotate relative to each other. Thus, the attachment parts may be adapted to come into contact and/or penetrate tissue of the gastrointestinal tract. The rotation of the body parts relative to each other using a resilient force may move the attachment parts in such a way that they are capable of e.g. penetrating or pinching the mucous membrane in order to fix the drug delivery device at a location in the gastrointestinal tract, such as the stomach or intestines. The penetrating and/or pinching force may come from the actuator mechanism/resilient part, where the resilient part may be adapted to store a resilient force that is capable of forcing the attachment parts towards each other when the resilient force of the resilient part has been at least partly unleashed. The resilient part may e.g. be in the form of a spring or spring element, for example a torsional spring or a power spring, where the spring may be wound up to store mechanical energy, where the mechanical energy may be transmitted to the first and/or the second body part. When the mechanical energy is released, the first body part may rotate relative to the second body part, and where the mechanical energy may be transferred into the attachment parts via the body parts.

Within the context of the present description the term "rotational force" may be seen as Torque, moment, moment of force, rotational force or "turning effect". Another definition of the term "rotational force" may be the product of the magnitude of the force and the perpendicular distance of the line of action of force from the axis of rotation. The rotational force may be seen as the force which is transferred from the resilient part to the attachment members of the drug delivery device via the body parts.

The rotational force may be defined as being large enough to penetrate into the gastrointestinal tissue. When the rotational force is applied to both the first and the second body part, the first attachment member may come into contact with the surface to be attached to, and where the rotational force applied to the second body part may cause the second attachment part to come into contact with the same surface, where the first attachment part provides a force, while the second attachment part provides a counter force to the first attachment part, so that the force is applied in such a manner that the first attachment part is forced in a direction towards the second attachment part, or vice versa.

In one or more exemplary drug delivery devices, a distance between the first attachment axis of the first attachment part and the primary axis, e.g. at least in an activated state or

second state of the drug delivery device and optionally in an initial state of the drug delivery device, is larger than 0.5 mm.

In one or more exemplary drug delivery devices, a distance between the second attachment axis of the second attachment part and the primary axis, e.g. at least in an activated state or second state of the drug delivery device and optionally in an initial state of the drug delivery device, is larger than 0.5 mm.

In one or more exemplary drug delivery devices, the first attachment part is rotationally attached to the first body part, e.g. via a first joint connection having a first rotation axis. In other words, the first attachment part is optionally configured to rotate about a first rotation axis, e.g. in relation to the first body part. The first rotation axis may be parallel to the central axis and/or the primary axis. The first rotation axis may form a first angle with the central axis and/or the primary axis. The first angle may be less than 15°. The first angle may be in the range from 75° to 105°, such as 90°±5° or 90°.

In one or more exemplary drug delivery devices, the first body part may define a first body recess (e.g., cavity, slot, hole) extending to an outer surface of the first body part. The first body recess may be formed by solid walls on all sides except an outermost surface which is open. The first attachment part may be rotationally connected within the first body recess along a first attachment part axis. The first attachment part axis may be, for example, a pin (e.g., arm, support). The first attachment part axis may be parallel to the central axis and/or the primary axis. The first attachment part axis may be angled with respect to the central axis and/or the primary axis. Accordingly, the first attachment part may be configured to rotate within the recess along the first attachment part axis. Further, rotation of the first attachment part may be stopped at end surfaces of the recess.

The first body recess may extend along a portion of the outer surface of the first body. The first body recess may extend fully along an outer circumference of the first body. The first body recess may extend around 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100% of an outer circumference of the first body. The first body recess may extend around greater than 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or 95% of an outer circumference of the first body. The first body recess may extend around less than 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100% of an outer circumference of the first body. The first body may optionally contain more than one first body recess, for example of a plurality of first attachment parts

are used on the first body. If more than one first body recess is used, they may be spaced longitudinally apart and/or circumferentially apart.

The first body recess may extend from an outer surface toward the central axis through 5, 10, 15, 20, 25, 30, 35, or 40% of the drug delivery device. The first body recess may
5 extend from an outer surface toward the central axis through greater than 5, 10, 15, 20, 25, 30, 35, or 40% of the drug delivery device. The first body recess may extend from an outer surface toward the central axis through less than 5, 10, 15, 20, 25, 30, 35, or 40% of the drug delivery device.

In one or more exemplary drug delivery devices, the first body recess may extend
10 circumferentially, or partially circumferentially around the first body with the central axis being the longitudinal direction. The first body recess may extend perpendicularly with respect to the central axis and/or the primary access (e.g., may extend along a cross section of the drug delivery device perpendicular to the central axis and/or the primary access). The first body recess may have any number of shapes. For example, the first
15 body recess can be a portion of a circle, such as a half circle. The first body recess can be a triangle. The first body recess can be a sector of a circle. The first body recess can be a curved edge connected by two straight edge. The first body recess can be two curved edges connected to each other by two straight edges.

Thus, the first attachment part may rotate on the first attachment part axis in order to
20 move perpendicular to the central axis and/or the primary axis. In certain embodiments, the first attachment part may rotate at an angle between perpendicular and parallel with respect to the central axis and/or the primary axis.

In one or more exemplary drug delivery devices, when the first body part and/or the second body part rotate with respect to one another, the first attachment part and/or the
25 second attachment part can rotate out of their respective recesses (e.g., first body recess and second body recess) due to the rotation of the first body part and/or the second body part. The continued rotation of the first body part and/or the second body part then causes the first attachment part and/or the second attachment part to pierce tissue to hold the drug delivery device in place.

30 In one or more exemplary drug delivery devices, the first attachment part extends, e.g. at least in an activated state of the drug delivery device and optionally in an initial state of the drug delivery device, in a direction away from the first body part. In other words, the

first needle may extend, e.g. at least in an activated state of the drug delivery device and optionally in an initial state, from an outer surface of the first body part. Formulated differently, the first attachment axis may, e.g. at least in an activated state of the drug delivery device and optionally in an initial state of the drug delivery device form an angle of at least 45° with the central axis and/or the primary axis. An attachment part extending in a direction is to be understood as the direction from proximal end of attachment part/needle part to distal end of attachment part along the attachment axis of the attachment part.

The first attachment part may in a first state of the drug delivery device extend in a first primary direction and in a second state of the drug delivery device extend in a first secondary direction. The first primary direction and the first secondary direction may form an angle of at least 30°. The first primary direction may be parallel or substantially parallel to the central axis. The first primary direction may form an angle less than 60° with the central axis. The first secondary direction may form an angle of at least 60° such as about 90° with the central axis. The first secondary direction may be perpendicular to the central axis.

The first distal end of the first attachment part may be configured to move or be moved from a first primary position in a first state of the drug delivery device to a first secondary position in the second state.

The drug delivery device comprises a second attachment part. The second attachment part may comprise a second base part and/or a second needle, e.g. spike. The second attachment part has a second proximal end and a second distal end. The second attachment part, such as the second needle, optionally has or extends along a second attachment axis. A second tip of the second needle forms the second distal end. In other words, the second distal end is a second tip of the second needle. The second base may be arranged at or constitute the second proximal end of the second attachment part. The second needle may have a length in the range from 1 mm to 15 mm such, as in the range from 3 mm to 10 mm. Thereby sufficient penetration into the internal tissue may be provided for while at the same time reducing the risk of damaging the internal tissue. The second distal end of the second attachment part may be provided with a tip configured to penetrate a biological tissue. The second distal end of the second attachment part may be provided with a gripping part configured to grip a biological tissue.

The second needle may have a cross-sectional diameter in the range from 0.1mm to 5mm, such as in the range from 0.5mm to 2.0mm.

The second needle may be straight and/or curved. The second needle may comprise a second primary section that is straight. The second needle may comprise a second
5 secondary section, e.g. between the second primary section and the second distal end or between the second base and the second primary section. The second secondary section may be curved.

The second needle may include two or more straight portions formed at an angle. For example, the second needle may have a proximal portion that extends at a first angle
10 from a connection point to the drug delivery device and a distal portion that extends at a second angle from a connection point to the drug delivery device. The first angle and the second angle may be different. The proximal portion may connect to the distal portion at a joint (e.g., bend, connection, angle) and have a joint angle between the proximal portion and the distal portion. The joint angle may be an acute angle, an obtuse angle, or a right
15 angle. The angle may be, for example, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 130, 140, 150, 160, or 170 degrees. This can advantageously allow for different angles of attach when the second needle interacts with inner surface linings. This may allow for improved attachment of the drug delivery device, while helping to reduce or avoid tissue damage. Further, the joint may be flexible. Alternatively, the joint may not be flexible.

20 The joint may be located at a center, or generally at a center, of a length of the second needle. Alternatively, the joint may be located 40, 45, 55, 60, or 65% up a length of the second needle from the proximal end.

In one or more exemplary second attachment parts, the second needle may have three, four, or five different portions at different angles, each connected by a joint. In some
25 iterations, any or all of the different portions may be straight or curved. Each joint may be flexible or not flexible.

In one or more exemplary drug delivery devices, both the first needle and the second needle include a joint. However, only one of the first needle and the second needle may include a joint with the other being straight and/or curved. If both the first needle and the
30 second needle include a joint, the first distal tip and the second distal tip may be angled towards one another in order to facilitate attachment when the first body part and the second body part rotate with respect to one another.

In one or more exemplary drug delivery devices, the second attachment part is rotationally attached to the second body part, e.g. via a second joint connection having a second rotation axis. In other words, the second attachment part is optionally configured to rotate about a second rotation axis, e.g. in relation to the second body part. The second rotation axis may be parallel to the central axis and/or the primary axis. The second rotation axis may form a second angle with the central axis and/or the primary axis. The second angle may be less than 15°. The second angle may be in the range from 75° to 105°, such as 90°±5° or 90°.

In one or more exemplary drug delivery devices, the second body part may define a second body recess (e.g., cavity, slot, hole) extending to an outer surface of the second body part. The second body recess may be formed by solid walls on all sides except an outermost surface which is open. The second attachment part may be rotationally connected within the second body recess along a second attachment part axis. The second attachment part axis may be, for example, a pin (e.g., arm, support). The second attachment part axis may be parallel to the central axis and/or the primary axis. The second attachment part axis may be angled with respect to the central axis and/or the primary axis. Accordingly, the second attachment part can be configured to rotate within the recess along the second attachment part axis. Further, rotation of the second attachment part may be stopped at end surfaces of the second body recess.

The second body recess may extend along a portion of the outer surface of the second body. The second body recess may extend fully along an outer circumference of the second body. The second body recess may extend around 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100% of an outer circumference of the second body. The second body recess may extend around greater than 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or 95% of an outer circumference of the second body. The second body recess may extend around less than 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100% of an outer circumference of the second body. The second body may optionally contain more than one second body recess, for example of a plurality of second attachment parts are used on the second body. If more than one second body recess is used, they may be spaced longitudinally apart and/or circumferentially apart.

The second body recess may extend from an outer surface toward the central axis through 5, 10, 15, 20, 25, 30, 35, or 40% of the drug delivery device. The second body

recess may extend from an outer surface toward the central axis through greater than 5, 10, 15, 20, 25, 30, 35, or 40% of the drug delivery device. The second body recess may extend from an outer surface toward the central axis through less than 5, 10, 15, 20, 25, 30, 35, or 40% of the drug delivery device.

- 5 In one or more exemplary drug delivery devices, the second body recess may extend circumferentially, or partially circumferentially around the second body with the central axis being the longitudinal direction. The second body recess may extend perpendicularly with respect to the central axis and/or the primary access (e.g., may extend along a cross section of the drug delivery device perpendicular to the central axis and/or the primary
- 10 access). The second body recess may have any number of shapes. For example, the second body recess can be a portion of a circle, such as a half circle. The second body recess can be a triangle. The second body recess can be a sector of a circle. The second body recess can be a curved edge connected by two straight edge. The second body recess can be two curved edges connected to each other by two straight edges.
- 15 Thus, the second attachment part may rotate on the second attachment part axis in order to move perpendicular to the central axis and/or the primary axis. In certain embodiments, the second attachment part may rotate at an angle between perpendicular and parallel with respect to the central axis and/or the primary axis.

- In one or more exemplary drug delivery devices, when the first body part and/or the
- 20 second body part rotate with respect to one another, the first attachment part and/or the second attachment part can rotate out of their respective recesses (e.g., first body recess and second body recess) due to the rotation of the first body part and/or the second body part. The continued rotation of the first body part and/or the second body part then causes the first attachment part and/or the second attachment part to pierce tissue to hold the
- 25 drug delivery device in place.

- In one or more exemplary drug delivery devices, the second attachment part extends, e.g. at least in an activated state of the drug delivery device and optionally in an initial state of the drug delivery device, in a direction optionally away from the second body part. In other words, the second needle may extend, e.g. at least in an activated state of the drug
- 30 delivery device and optionally in an initial state, from an outer surface of the second body part. Formulated differently, the second attachment axis may, e.g. at least in an activated state of the drug delivery device and optionally in an initial state of the drug delivery device form an angle of at least 45° with the central axis and/or the primary axis.

The second attachment part may in a first state of the drug delivery device extend in a second primary direction and in a second state of the drug delivery device extend in a second secondary direction. The second primary direction and the second secondary direction may form an angle of at least 30°. The second primary direction may be parallel
5 or substantially parallel to the central axis. The second primary direction may form an angle less than 60° with the central axis. The second secondary direction may form an angle of at least 60°, such as about 90° with the central axis. The second secondary direction may be perpendicular to the central axis.

The second distal end of the second attachment part may be configured to move or be
10 moved from a second primary position in a first state of the drug delivery device to a second secondary position in the second state.

The drug delivery device comprises an actuator mechanism. The actuator mechanism is configured to move the first attachment part in relation to the second attachment part, such as configured to move the first distal end towards and/or away from the second
15 distal end, e.g. at least during a part of a rotation, such as in a first rotation and optionally in a second rotation. To move the first distal end towards the second distal end may be understood as reducing a distance between the first distal end and the second distal end. To move the first distal end towards the second distal end may be understood as reducing an angle between the first attachment axis and the second attachment axis, such as
20 reducing an angle between a first secondary direction of the first attachment part and a second secondary direction of the second attachment part. For example, the actuator mechanism can be configured to rotate one of the first body part and the second body part.

In one or more example drug delivery devices, the actuator mechanism can include a
25 resilient part. For example, the actuator mechanism optionally comprises a resilient part such as a spring element configured to apply force to the first body part and/or the second body part. The resilient part may comprise a first part, such as a first end, connected to the first body part. The resilient part may comprise a second part, such as a second end, connected to the second body part.

30 In one or more exemplary drug delivery devices, the actuator mechanism may be offset. The actuator mechanism may be an offset actuator mechanism. The actuator mechanism may be offset with respect to a longitudinal length of the drug delivery device. For example, the actuator mechanism may be located, such as positioned, placed, attached,

more towards one longitudinal side of the drug delivery device than the opposite side of the drug delivery device. The actuator mechanism may be longitudinally offset with regards to a longitudinal center of the drug delivery device.

The drug delivery device may have a longitudinal and/or radial center point. The center point may be a center of mass. The center point may be a center of a particular dimensions, such as length and/or width of the drug delivery device. The actuator mechanism may be offset from the center point.

For example, the actuator mechanism may be longitudinally offset in the drug delivery device. The actuator mechanism may be longitudinally offset with respect to the first body part and the second body part. The actuator mechanism may be transversely offset. The actuator mechanism may be longitudinally offset. The actuator mechanism may not be centered in the drug delivery device. The actuator mechanism may not be longitudinally-centered in the drug delivery device. A majority of the actuator mechanism may be located more towards the first longitudinal end than the second longitudinal end.

The drug delivery device may have a central axis. The central axis can extend from a first longitudinal end of the drug delivery device to a second longitudinal end of the drug delivery device. The central axis may be a longitudinal axis of the drug delivery device. The central axis may be angled from a longitudinal axis of the drug delivery device. The central axis may be offset from a longitudinal axis of the drug delivery device. The central axis may be parallel with the longitudinal axis of the drug delivery device. The central axis may intersect with the longitudinal axis of the drug delivery device.

In one or more example drug delivery devices, the first body part can form a portion of the first longitudinal end. In one or more example drug delivery devices, the second body part can form a portion of the second longitudinal end. In one or more example drug delivery devices, the first body part can a portion of the first longitudinal end and/or the second body part can form a portion of the second longitudinal end. The first body part may form an entirety of the first longitudinal end. The second body part may form an entirety of the second longitudinal end.

In one or more exemplary drug delivery devices, the actuator mechanism can be located more towards the first longitudinal end of the drug delivery device than the second longitudinal end of the drug delivery device along the central axis. The actuator mechanism may not be centered in the drug delivery device. The actuator mechanism

may not be longitudinally centered in the drug delivery device. The actuator mechanism may be off longitudinal center in the drug delivery device.

For example, the actuator mechanism may be located more in the first body part than in the second body part. The actuator mechanism may be located more towards the first longitudinal end than the second longitudinal end. The actuator mechanism may be located more towards the first longitudinal end than the second longitudinal end by one or more of: dimensions, weight, mass, height, width, length, and depth. The actuator mechanism may be symmetrical along the central and/ longitudinal axis. The actuator mechanism may be asymmetrical along the central and/or longitudinal axis.

10 In one or more exemplary drug delivery devices, the actuator mechanism can be located fully within the first body part. For example, no portion of the actuator mechanism can be located within the second body part.

The actuator mechanism may include a resilient part. The resilient part may be located more in the first body part than in the second body part. The resilient part may be located more towards the first longitudinal end than the second longitudinal end. The resilient part may be located more towards the first longitudinal end than the second longitudinal end by one or more of: dimensions, weight, mass, height, width, length, and depth. In one or more exemplary drug delivery devices, the resilient part can be located fully within the first body part. For example, no portion of the resilient part can be located within the second body part.

The actuator mechanism may be located more in the second body part than in the first body part. The actuator mechanism may be located more towards the second longitudinal end than the first longitudinal end. The actuator mechanism may be located more towards the second longitudinal end than the first longitudinal end by one or more of: dimensions, weight, mass, height, width, length, and depth. In one or more exemplary drug delivery devices, the actuator mechanism can be located fully within the second body part. For example, no portion of the actuator mechanism can be located within the first body part.

The resilient part may be located more in the second body part than in the first body part. The resilient part may be located more towards the second longitudinal end than the first longitudinal end. The resilient part may be located more towards the second longitudinal end than the first longitudinal end by one or more of: dimensions, weight, mass, height, width, length, and depth. In one or more exemplary drug delivery devices, the resilient

part can be located fully within the second body part. For example, no portion of the resilient part can be located within the first body part.

In one or more exemplary drug delivery devices, the actuator mechanism can be located partially within the first body part and partially within the second body part. The resilient
5 part can be located partially within the first body part and partially within the second body part. While spanning both the first body part and the second body part, the actuator mechanism may still be offset in the drug delivery device as a whole.

In one or more exemplary drug delivery devices, the actuator mechanism can be centered on the central axis. For example, while the actuator mechanism can be located more
10 towards the first longitudinal end than the second longitudinal end, the central axis may pass through a center of the actuator mechanism. Alternatively, the actuator mechanism can be radially offset from a centerline of the drug delivery device.

In one or more exemplary drug delivery devices, the actuator mechanism can be located more towards the first longitudinal end than the attachment part. Alternatively, the
15 attachment part may be located more towards the first longitudinal end than the actuator mechanism. The actuator mechanism and the attachment part may be located the same distance from the first longitudinal end. For example, the attachment part may be longitudinally centered while the actuator mechanism is offset.

The attachment part may longitudinally overlap the actuator mechanism. The attachment
20 part may not longitudinally overlap the actuator mechanism.

In one or more exemplary drug delivery devices, the actuator mechanism is configured to move the first distal end towards the second distal end by rotating, e.g. in a second state of the drug delivery device, the first body part in relation to the second body part and/or vice versa. The actuator mechanism may be configured to rotate the first body part at
25 least 90°, such as at least 450°, at least 810°, at least 1170°, at least 1530°, or even at least 1890° in relation to the second body part about the primary axis. The actuator mechanism may be configured to rotate the first body part in relation to the second body part about the primary axis in a stepwise manner. In other words, to rotate the first body part in relation to the second body part about the primary axis may comprise a plurality of
30 rotations including a first rotation and a second rotation, e.g. a first rotation followed by a first time period with reduced or no rotation followed by a second rotation. A first rotation followed by a second rotation after a first time period may increase the possibility of the

drug delivery device attaching to the biological tissue. The first time period or in general time periods between rotations allows the drug delivery to move to other positions in the gastrointestinal tract. In other words, if the drug delivery does not attach to the biological tissue during a first rotation, further rotations increase the chance of attachment to the
5 internal tissue. The first rotation may be at least 90° , and the second rotation may be at least 180° . The plurality of rotations may comprise a third rotation. The third rotation may be at least 180° .

In one or more exemplary drug delivery devices, the drug delivery device may include a second attachment part. The second attachment part can be connected to the second
10 body part. The actuator mechanism can be located between the attachment part and the second attachment part. The attachment part may be located between the actuator mechanism and the second attachment part. The second attachment part may be located between the actuator mechanism and the attachment part.

Alternatively, the attachment part can be connected to the second body part and the
15 second attachment part can be connected to the first body part.

The second attachment part may longitudinally overlap the actuator mechanism. The second attachment part may not longitudinally overlap the actuator mechanism. The attachment part and the second attachment part may longitudinally overlap the actuator mechanism. The attachment part and the second attachment part may not longitudinally
20 overlap the actuator mechanism. Neither the attachment part nor the second attachment part may longitudinally overlap the actuator mechanism.

The attachment part and the second attachment part can be spaced apart from one another along the longitudinal axis of the drug delivery device. The attachment part and the second attachment part can be spaced apart from one another along the central axis
25 of the drug delivery device. The central axis may be the same as the longitudinal axis. The central axis may not be the same as the longitudinal axis.

In one or more example drug delivery devices, the second attachment part and the attachment part can be within 10mm of each other along the central axis. For example, In one or more example drug delivery devices, the second attachment part and the
30 attachment part can be within 10mm of each other along the longitudinal axis. The second attachment part can be spaced 10mm or less away from the attachment part. For example, a distal tip of the attachment part can be within 10mm of the second distal tip of

the second attachment part. A base of the attachment part can be within 10mm of the base of the second attachment part. A center of the attachment part can be within 10mm of a center of the second attachment part.

In one or more example drug delivery devices, the second attachment part and the attachment part can be within 4.1mm of each other along the central axis. For example, In one or more example drug delivery devices, the second attachment part and the attachment part can be within 4.1mm of each other along the longitudinal axis. The second attachment part can be spaced 4.1mm or less away from the attachment part. For example, a distal tip of the attachment part can be within 4.1mm of the second distal tip of the second attachment part. A base of the attachment part can be within 4.1mm of the base of the second attachment part. A center of the attachment part can be within 4.1mm of a center of the second attachment part.

In one or more example drug delivery devices, the second attachment part and the attachment part can be within 3.9mm of each other along the central axis. For example, In one or more example drug delivery devices, the second attachment part and the attachment part can be within 3.9mm of each other along the longitudinal axis. The second attachment part can be spaced 3.9mm or less away from the attachment part. For example, a distal tip of the attachment part can be within 3.9mm of the second distal tip of the second attachment part. A base of the attachment part can be within 3.9mm of the base of the second attachment part. A center of the attachment part can be within 3.9mm of a center of the second attachment part.

In one or more example drug delivery devices, the second attachment part and the attachment part can be from 0-10mm away from one another along the central axis. In one or more exemplary drug delivery devices, a movement of the first distal end towards the second distal end may be preceded by and/or followed by a movement of the first distal end away from the second distal end. In other words, a movement of the first distal end towards the second distal end may be prior to and/or after movement of the first distal end away from the second distal end. For example, a first rotation may comprise moving the first distal end towards the second distal end and/or moving the first distal end away from the second distal end. For example, a second rotation may comprise moving the first distal end towards the second distal end and/or moving the first distal end away from the second distal end. For example, a third rotation may comprise moving the first distal end

towards the second distal end and/or moving the first distal end away from the second distal end.

In one or more exemplary drug delivery devices, the actuator mechanism optionally comprises a swelling media, i.e. a media increasing its volume, e.g. upon contact with a fluid, e.g. in order to provide rotation of parts in relation to each other. In one or more exemplary drug delivery devices, a swelling medial provides rotation of the first attachment part in relation to the first body part and/or provides rotation of the second attachment part in relation to the second body part. In one or more exemplary drug delivery devices, a swelling media provides rotation of the first body part in relation to the second body part.

The actuator mechanism, such as the resilient part, may be configured to rotate the first attachment part about the first rotation axis in relation to the first body part.

The actuator mechanism, such as the resilient part, may be configured to rotate the second attachment part about the second rotation axis in relation to the second body part.

In one or more exemplary drug delivery devices, the drug delivery device comprises a first compartment, the drug delivery device being configured to deliver an active drug substance from the first compartment to the surroundings of the drug delivery device. The first compartment may be arranged in the first attachment part, such as in the first needle, e.g. within a distance of 8 mm, such as within 5 mm, from the first distal end. The first attachment part, such as the first needle may have one or more openings providing access to the first compartment. In one or more exemplary drug delivery devices, the first compartment is formed as a through-going bore in the first needle. In one or more example drug delivery devices, the attachment part can be configured to provide an active drug substance.

The first compartment may be arranged in any part of the drug delivery device, such as in the form of a cavity inside a volume of the first body part, the second body part or both of the first body part and the second body part. Additionally, or alternatively, the first compartment may be a compartment which is inside the first attachment part, where the penetration of the first attachment part into a biological tissue may release a drug substance in the first compartment into the biological tissue. Additionally or alternatively, the first compartment may be compartment that is in the form of a depression or opening or spike or hollow spike on the outer surface of the first and/or the second body part,

where the drug delivery device may be adapted to release the drug substance inside the organ of the body which the drug delivery device is adapted to pass through.

In one or more exemplary drug delivery devices, the first compartment may be open from an inner volume of the drug delivery device and towards an outer part of the drug delivery device. In one or more examples, the first compartment may be inside the first body part, and where the first compartment is in fluid connection with the first attachment part, so that when the first distal end of the first attachment part has penetrated the biological tissue, the drug substance may be released from the first compartment and into the biological tissue via the first attachment part. This may e.g. be where the first attachment part is a tubular part, which has a first distal end in fluid communication with the first compartment of the drug delivery device.

In one or more exemplary drug delivery devices, the drug delivery device comprises a second compartment, the drug delivery device being configured to deliver an active drug substance from the second compartment to the surroundings of the drug delivery device. The second compartment may be arranged in the first attachment part or in the second attachment part, such as in the second needle, e.g. within a distance of 8 mm, such as within 5 mm, from the second distal end. The second attachment part, such as the second needle may have one or more openings providing access to the second compartment. In one or more exemplary drug delivery devices, the second compartment is formed as a through-going bore in the first needle or in the second needle.

In one or more exemplary drug delivery devices, the first attachment part and the second attachment part form an angle when the first distal end and the second distal end are in a plane that includes the primary axis. In other words, the first attachment axis and the second attachment may form an angle, e.g. larger than 5°, such as in the range from 10° to 75°, when the first distal end and the second distal end are in a plane that includes the primary axis.

In one or more exemplary drug delivery devices, the drug delivery device has a first state, also denoted initial state, where the first body part and the second body part are rotationally stationary relative to each other and a second state, also denoted activated state, where the first body part and the second body part are rotationally mobile relative to each other, e.g. can rotate about the primary axis of the drug delivery device. In other words, the first body part may be locked, e.g. prevented from rotating, in relation to the second body part. The first state may e.g. be an initial state or introduction state, where

the drug delivery device is adapted to be introduced into the body, and where the first body part and the second body part are stationary relative to each other. In the first state the resilient part may have a predefined amount of stored energy, where the energy level is stationary in the resilient part while the body parts are stationary.

- 5 In one or more exemplary drug delivery devices, the drug delivery device has a first state where the resilient part has a constant resilient force load and a second state where the resilient part at least partly releases the resilient force load. In other words, the resilient part may be biased or preloaded in the first state of the drug delivery and upon release, e.g. by release of a locking mechanism, (i.e. the drug delivery device being in the second
10 state) the force from the resilient part may affect a rotation of the first body part in relation to the second body part, i.e. including a movement of the first distal end towards the second distal.

In one or more exemplary drug delivery devices, the actuator mechanism is configured to move the first distal end from a first primary position, e.g. in first state of the drug delivery
15 device, with a first primary radial distance from a central axis of the delivery device to a first secondary position, e.g. in second state of the drug delivery device, with a first secondary radial distance from the central axis and/or primary axis, wherein the first secondary radial distance is larger than the first primary radial distance. Thus, the first distal end of the first attachment may be in a first primary position when the drug delivery
20 device is in the first state and/or the first distal end of the first attachment part may be in a first secondary position when the drug delivery device is in the second state.

The first primary radial distance may be less than 10 mm, such as less than 8 mm or even less than 5 mm. The first secondary radial distance may be larger than the first primary radial distance. The first secondary radial distance may be larger than 5 mm, such as
25 larger than 6 mm, or larger than 8 mm. In one or more exemplary drug delivery devices, the first secondary radial distance is in the range from 6 mm to 15 mm.

In one or more exemplary drug delivery devices, the first attachment part, such as a part of the first needle and/or the first distal end, may, in the first state be arranged or at least partly arranged within a first primary recess of the first body part. In the first state, the first
30 distal end may be arranged inside the first body part.

In one or more exemplary drug delivery devices, the first attachment part, such as a part of the first needle and/or the first distal end, may, in the second state be arranged or at least partly arranged outside the first primary recess of the first body part.

5 In one or more exemplary drug delivery devices, the first attachment part, such as a part of the first needle and/or the first distal end, may, in the first state be arranged within a second primary recess of the second body part. Thereby, the first attachment part may be configured to lock the first body part in relation to the second body part in the first state of the drug delivery device.

10 In one or more exemplary drug delivery devices, the first attachment part, such as a part of the first needle and/or the first distal end, may, in the second state be arranged outside the second body part and/or at least outside the second primary recess of the second body part.

In one or more exemplary drug delivery devices, the actuator mechanism is configured to move the second distal end from a second primary position, e.g. in first state of the drug delivery device, with a second primary radial distance from a central axis of the delivery device to a second secondary position, e.g. in second state of the drug delivery device, with a second secondary radial distance from the central axis and/or primary axis, wherein the second secondary radial distance is larger than the second primary radial distance. Thus, the second distal end of the second attachment may be in a second primary position when the drug delivery device is in the first state and/or the second distal end of the second attachment part may be in a second secondary position when the drug delivery device is in the second state.

25 The second primary radial distance may be less than 10 mm, such as less than 8 mm or even less than 5 mm. The second secondary radial distance may be larger than the second primary radial distance. The second secondary radial distance may be larger than 5 mm, such as larger than 6 mm, or larger than 8 mm. In one or more exemplary drug delivery devices, the second secondary radial distance is in the range from 6 mm to 15 mm.

30 In one or more exemplary drug delivery devices, the second attachment part, such as a part of the second needle and/or the second distal end, may, in the first state be arranged or at least partly arranged within a first secondary recess of the first body part. Thereby, the second attachment part may be configured to lock the first body part in relation to the

second body part in the first state of the drug delivery device. In the first state, the second distal end may be arranged inside the second body part.

In one or more exemplary drug delivery devices, the second attachment part, such as a part of the second needle and/or the second distal end, may, in the second state be
5 arranged or at least partly arranged outside the first body part and/or at least outside the first secondary recess of the first body part.

In one or more exemplary drug delivery devices, the second attachment part, such as a part of the second needle and/or the second distal end, may, in the first state be arranged within a second secondary recess of the second body part.

10 In one or more exemplary drug delivery devices, the second attachment part, such as a part of the second needle and/or the second distal end, may, in the second state be arranged outside the second secondary recess of the second body part.

In one or more exemplary drug delivery devices, the actuator mechanism is configured to move, e.g. by rotation about a first rotation axis of the first attachment part (first base
15 part), the first distal end from a first primary angular position of first primary position to a first secondary angular position of first secondary position in relation to a first proximal end of the first attachment part. An angle between the first primary angular position and the first secondary angular position may be larger than 10°, such as larger than 45° or larger than 60°.

20 In one or more exemplary drug delivery devices, the actuator mechanism is configured to move, e.g. by rotation about a second rotation axis of the second attachment part (second base part), the second distal end from a second primary angular position of second primary position to a second secondary angular position of second secondary position in relation to a second proximal end of the second attachment part. An angle between the
25 second primary angular position and the second secondary angular position may be larger than 10°, such as larger than 45° or larger than 60°.

In one or more exemplary drug delivery devices, the drug delivery device comprises a locking mechanism. The locking mechanism may be configured to lock, e.g. prevent rotation of, the first body part in relation to the second body part in a first state of the drug
30 delivery device. The locking mechanism may be configured to lock the first attachment part in a first primary position, e.g. in relation to the first body part, when the drug delivery

device is in the first state. Upon release of the locking mechanism, the first attachment part may be allowed to move from a first primary position to a first secondary position. The locking mechanism may upon release be configured to allow rotation of the first body part in relation to the second body part, e.g. in a second state of the drug delivery device. The

5 locking mechanism may be configured to lock the second attachment part in a second primary position, e.g. in relation to the second body part, when the drug delivery device is in the first state. The locking mechanism may upon release be configured to allow the second attachment part to move from a second primary position to a second secondary position.

- 10 The locking mechanism may comprise a first locking element optionally configured to lock and/or unlock (release) the first body part in relation to the second body part. The first locking element may be configured to lock and/or unlock (release) the first attachment part in relation to the first body part. The first locking element may be configured to lock and/or unlock (release) the second attachment part in relation to the second body part.
- 15 The first locking element may be arranged in a first primary recess of the first body part and/or in a second primary recess of the second body part. The first locking element may be configured to dissolve when the drug delivery device enters the gastrointestinal tract or at a desired location in the gastrointestinal tract, thereby releasing the first body part in relation to the second body part and allowing the actuator mechanism to rotate the first
- 20 body part in relation to the second body part and thereby moving the first distal end towards the second distal end in turn resulting in attachment of the drug delivery device to the internal tissue.

The first locking element may be a first locking band (e.g., ring, loop, partial ring, partial loop). The first locking band may have a circumferential length greater than a longitudinal

25 width. For example, the circumferential length may be 2x, 3x, 4x, 5x, 6x, 7x, 8x, 9x, or 10x the longitudinal width.

The first locking band may fit on an outer surface of the drug delivery device. For example, the first locking band may be located on an outer surface of the first body part or the second body part. The first locking band may be mechanically fit onto the drug

30 delivery device. For example, the first locking band may be snap fit onto the drug delivery device. The first locking band may be chemically attached onto the drug delivery device.

In one or more exemplary drug delivery devices, the first locking band could be in the shape of a capsule part. For example, the first locking band could form a first half of a

capsule. The first locking band could form a first half of a capsule and a second locking band could form a second half of the capsule. When fitted together, the first locking band and the second locking band could form a full capsule.

Advantageously, examples of the disclosed drug delivery device can have a reduced size.

- 5 In one or more example drug delivery devices, the drug delivery device can be a 000 size capsule. In one or more example drug delivery devices, the drug delivery device can be a 00 size capsule. In one or more example drug delivery devices, the drug delivery device can be a 0 size capsule.

In one or more example drug delivery devices, the drug delivery device can be a 000 size.

- 10 In one or more example drug delivery devices, the drug delivery device can be a 00 size. In one or more example drug delivery devices, the drug delivery device can be a 0 size.

Advantageously, examples of the disclosed drug delivery device combined with any covers, capsules, etc. to form a drug delivery system can have a reduced size. In one or more example drug delivery devices, the drug delivery system can be a 000 size capsule.

- 15 In one or more example drug delivery devices, the drug delivery system can be a 00 size capsule. In one or more example drug delivery devices, the drug system device can be a 0 size capsule.

In one or more example drug delivery devices, the drug delivery system can be a 000 size. In one or more example drug delivery devices, the drug delivery system can be a 00 size. In one or more example drug delivery devices, the drug delivery system can be a 0 size.

- 25 The first locking band may partially or fully cover the first body recess if located on the first body. Thus, the first locking band may prevent motion of the first attachment part. The first locking band may partially or fully cover the second body recess if located on the second body. Thus, the first locking band may prevent motion of the second attachment part. The first locking band may partially or fully cover both the first body recess and the second body recess. The first locking band may partially or fully cover the first body recess and a second locking band may partially or fully cover the second body recess.

- 30 The first locking band may extend fully along an outer circumference of the drug delivery device. The first locking band may extend around 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100% of an outer circumference of the drug delivery

device. The first locking band may extend around greater than 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, or 95% of an outer circumference of the drug delivery device. The first locking band may extend around less than 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, or 100% of an outer circumference of the
5 drug delivery device.

In one or more exemplary drug delivery devices, at least part of the first attachment part and/or the second attachment part may be made of a biodegradable material, absorbable material, or similar material which allows the material of the attachment part to be broken down, degraded and/or dissolved by processes that are present in the body, such as
10 corrosion, degradation, hydrolysis and/or proteolytic enzymatic degradation. Thus, when the attachment part(s) has been inside the human body for a period of time, the attachment part(s) may dissolve, decompose or degrade to such a degree that the attachment part may lose its structural stability, which may in turn release the drug delivery device from the surface it has attached itself to. Thus, after a period, e.g. when
15 the drug substance has been released from the attachment part(s), the attachment part(s) may deteriorate to such a degree that the drug delivery device may be released and may continue its journey through the gastrointestinal tract to be released through natural intestinal and/or bowel movements of the user or patient.

In one or more exemplary drug delivery devices, the rotational axis of the first body part
20 and/or the second body part (primary axis) may be the central axis of the drug delivery device, e.g. the primary axis of the first body part may be coaxial to the central axis. Thus, the central axis intersects both the first body part and the second body part, and may define the primary axis.

In one or more exemplary drug delivery devices, the first body part and the second body
25 part may be substantially symmetrical in a radial direction perpendicular to the central axis. This may mean that the first body part and/or the second body part may have a circular periphery, where the periphery may extend in a radial direction away from and perpendicular to the central axis.

The first attachment axis may be seen as an axis that is coaxial with the length of the first
30 attachment part. The second attachment axis may be seen as an axis that is coaxial with the length of the second attachment part. In case the first attachment part has a shape that is not straight, the first attachment axis may be defined as an axis that intersects the first distal end and the first proximal end of the first attachment part. In case the second

attachment part has a shape that is not straight, the second attachment axis may be defined as an axis that intersects the second distal end and the second proximal end of the second attachment part.

In one or more exemplary drug delivery devices, the first attachment axis may be
5 positioned at a first distance from the central axis, while the second attachment axis may be positioned at a second distance from the central axis and/or primary axis.

For example, the first attachment axis may be positioned at a first primary distance from the central axis in the first state of the drug delivery device. The first primary distance may be larger than 0.5 mm, such as in the range from 1 mm to 15 mm or larger than 1 mm,
10 e.g. 2 mm, 3 mm, 4 mm, 5 mm, 6mm, 7 mm, 8mm, 9mm, 10mm, 11mm, 12mm, 13 mm, or 14 mm.

The first attachment axis may cross or be close to (distance less than 0.5 mm) the central axis in the first state of the drug delivery device.

The first attachment axis may be positioned at a first secondary distance from the central
15 axis in the second state of the drug delivery device. The first secondary distance may be larger than 0.5 mm, such as in the range from 1 mm to 15 mm or larger than 1 mm, e.g. 2 mm, 3 mm, 4 mm, 5 mm, 6mm, 7 mm, 8mm, 9mm, 10mm, 11mm, 12mm, 13 mm, or 14 mm.

The first attachment axis may cross or be close to (distance less than 0.5 mm) the central
20 axis in the second state of the drug delivery device.

For example, the second attachment axis may be positioned at a second primary distance from the central axis in the first state of the drug delivery device. The second primary distance may be larger than 0.5 mm, such as in the range from 1 mm to 15 mm or larger than 1 mm, e.g. 2 mm, 3 mm, 4 mm, 5 mm, 6mm, 7 mm, 8mm, 9mm, 10mm, 11mm,
25 12mm, 13 mm, or 14 mm.

The second attachment axis may cross or be close to (distance less than 0.5 mm) the central axis in the first state of the drug delivery device.

The second attachment axis may be positioned at a second secondary distance from the central axis in the second state of the drug delivery device. The second secondary
30 distance may be larger than 0.5 mm, such as in the range from 1 mm to 15 mm or larger

than 1 mm, e.g. 2 mm, 3 mm, 4 mm, 5 mm, 6mm, 7 mm, 8mm, 9mm, 10mm, 11mm, 12mm, 13 mm, or 14 mm.

The second attachment axis may cross or be close to (distance less than 0.5 mm) the central axis in the second state of the drug delivery device.

- 5 In one or more exemplary drug delivery devices, the first attachment part (first attachment axis) and/or the second attachment part (second attachment axis) may be configured to be at an angle to each other when they intersect a plane that includes the central axis. The plane may be a plane that contains the central axis, where the plane also includes a radial axis extending at a right angle from the central axis. When the first attachment part
- 10 intersects the plane, the first attachment axis of the first attachment part may be at an angle to the plane so that the first distal end of the first attachment part is the first part of the first attachment part that intersects the plane, where the remaining parts of the first attachment part intersect the plane subsequently during rotational movement. The second attachment part may intersect the same plane from the opposite side, where the
- 15 second distal end of the second attachment part is the first part of the second attachment part that intersects the plane, where the remaining parts of the second attachment part intersect the plane subsequently during rotational movement. Thus, the second attachment part optionally intersects the plane from an opposing rotational direction than the first attachment part. This may also mean that when the first distal end and the second
- 20 distal end of respective first attachment part and second attachment parts each contact the plane, the first attachment part (first attachment axis) is at an angle to the plane as well as at an angle to the second attachment part (second attachment axis). The angle between the first attachment part (first attachment axis) and the second attachment part (second attachment axis) to the plane may be approximately half the size of the angle
- 25 between the first attachment part and the second attachment part.

- In one or more exemplary drug delivery devices, the first body part may be configured to rotate in a first direction and the second body part may be configured rotate in a second direction, where the first direction is opposite to the second direction. Thus, as an example, the first body part may rotate in a clockwise direction, while the second body
- 30 part may rotate in an opposed anti clockwise direction. In one or more examples where the drug delivery device comprises three or more body parts, abutting or neighbouring body parts may rotate in opposite directions. This may also mean that every second body part may rotate in the same direction. For example, where a first body part and a third

body part rotate in the same first direction, then a second body part and/or a fourth body part may rotate in a second direction opposite the first direction.

In one or more exemplary drug delivery devices, the actuator mechanism may comprise one or more resilient parts, such as a plurality of resilient parts.

- 5 In one or more exemplary drug delivery devices, the first distal end of the first attachment part and/or the second distal end of the second attachment part may be provided with a sharp tip configured to penetrate a biological tissue. The sharp tip may be positioned in the vicinity of the distal end of the respective attachment part, where the sharp tip may be configured to have a diameter at the distal end which is smaller than a diameter of the
- 10 attachment part at a distance from the distal end. The sharp tip may be configured in such a manner that when a rotational force is applied to the first attachment part, and a counterforce is applied to the second attachment part, the counterforce may cause the sharp tip to penetrate the biological tissue due to the force applied by the actuator mechanism.
- 15 When the first attachment part and/or the second attachment part penetrates the biological tissue due to the rotation between the first body part and the second body part (the first distal end moving towards the second distal end, the respective penetration point(s) in the biological tissue may be utilized to deliver a drug substance from the drug delivery device into the biological tissue, and where the drug substance may be
- 20 introduced into the biological tissue that is beyond the mucous membrane. Thereby, the drug substance may enter the bloodstream more easily than if the drug substance is released in the stomach or intestinal lumen, and the drug delivery may be more effective. An example of this is when the drug substance is insulin, where insulin may degrade inside the gastrointestinal tract and is not capable of being absorbed from the
- 25 gastrointestinal tract, but where a mucous membrane has been penetrated, and the insulin released through the penetrated gastrointestinal wall, the insulin will remain intact and reach the bloodstream of the user via the blood vessels in the intestinal layer beyond the mucous membrane (surface).

- In one or more exemplary drug delivery devices, the first attachment part and/or the
- 30 second attachment part may be provided with a gripping part configured to grip a biological tissue. The gripping part may be utilized to improve traction between the attachment part and a mucous membrane, allowing the attachment part to anchor the drug delivery device inside the body of the user. The gripping part may be a part that

increases a mechanical friction between the attachment part and the surface to be attached to, where the gripping part may e.g. have a hook shape, or e.g. a shape where the gripping part of the first attachment part faces the gripping part of the second attachment part, so that the biological tissue which is positioned between the first
5 attachment part and the second attachment part is gripped between the two gripping parts.

In one or more exemplary drug delivery devices, a part of the resilient part may be connected to the first body part and a second part of the resilient part may be connected to the second body part. This means that the resilient part may be utilized to store energy,
10 such as rotational energy or rotational force which is applied to the first body part and the second body part, where the energy is stored in the resilient part. Furthermore, when the energy is released, e.g. when a locking element is dissolved or degraded, the force may be released to both the first body part and the second body part, which in turn transfers the force to the first attachment part and the second attachment part. The resilient part
15 may e.g. be in the form of a helical spiral spring (mainspring) and/or a spiral torsion spring, where the first body part may be wound relative to the second body part by rotating the first body part relative to the second body part. This stores energy in the mainspring by twisting the spiral tighter. The stored force of the mainspring may then rotate the first body part in the opposing direction as the mainspring unwinds. Thus, the
20 force of the mainspring may cause the first attachment part and the second attachment parts to travel in opposing directions, and where the attachment parts may pinch the biological tissue and either pinch the tissue or penetrate the tissue in order to attach the drug delivery device to the biological tissue.

When the drug delivery device has entered the body, and has e.g. entered the desired
25 part in the gastrointestinal tract, the drug delivery device may be configured to transform from the first state to the second state. The transformation may be initiated by different means, where e.g. the first and the second body parts may be held in the first state using a locking mechanism e.g. comprising one or more locking elements made of a dissolvable, expandable or degradable material, where the material reacts with the
30 surroundings, such as fluids, inside the desired body part, thereby unlocking or releasing the locking mechanism. The material of the locking elements may be a material that loses its structural force when in contact with the surroundings inside the desired body part. An example may be where locking element(s) is made of a polymeric material or a sugary substance which may dissolve, expand or degrade when it comes into contact with a

certain kind of fluid which may include an enzyme or a certain kind of acid inside the digestive system. When the locking element comes into contact with the reagent, the material may dissolve, expand or degrade over time, and when the rotational force of the drug delivery device exceeds the static force of the locking element, the rotational force
5 may be released via a rotation of the first body part relative to the second body part, or vice versa.

In one or more exemplary drug delivery devices, a locking element may fix an attachment part in a position where the attachment element locks the first body part in relation to the second part, i.e. prevents the first body part from rotating in relation to the second body
10 part. When the locking element dissolves or degrades, the attachment part can move to a secondary position where the attachment part does not lock the first body part in relation to the second part, e.g. by the actuator mechanism causing a rotation of the attachment part about a rotation axis in relation to the body part to which the attachment part is rotationally attached.

15 The second state of the drug delivery device may be seen as the state which is initiated by the release of energy stored in the actuator mechanism, e.g. resilient part(s) of the actuator mechanism into a rotational force of the first and/or the second body part and/or a rotational force of the first attachment part in relation to the first body part. A termination of the second state may be seen as a point in time where the energy stored in the resilient
20 part becomes stationary again, i.e. when the attachment parts have gripped or penetrated biological tissue and/or the rotational movement between the first body part and the second body part is stopped.

In one or more exemplary drug delivery devices, the drug delivery device may have a first state where the actuator mechanism has a constant resilient force load and a second
25 state where the actuator mechanism releases the resilient force load. In the first state, the constant resilient force load may be seen as the energy stored in the actuator mechanism, and where the resilient force load is larger than zero. The second state may be seen as a state where the actuator mechanism releases its resilient force load, where the resilient force load is reduced, e.g. approaches zero, e.g. by rotating the first body part in relation
30 to the second body part. The second state may be terminated when the attachment parts come into contact with or penetrates a biological tissue and the resilient force load does not change, even though it has not reached zero. Thus, a third state may follow the

second state, when the drug delivery device has been attached to a wall of biological material, and the resilient force load is stationary after a resilient force release.

The first attachment part and/or the second attachment part may have an unfolding function, where during the first state of the drug delivery device, i.e. the initial state of the drug delivery device, the attachment parts are positioned or arranged inside the first and/or the second body part, or alternatively where the first and/or second attachment parts may be folded along the sides of the body parts. Other ways of obtaining the same may be envisioned. The folded state (first state) may e.g. be maintained using a releasable locking mechanism in the form of an encapsulation similar to a drug substance capsule, a band or plug, e.g. made of gelatine, sugars or other dissolvable materials or materials that lose their structural force. Thus, the attachment parts may be held in place until the drug delivery device has entered the gastrointestinal tract, e.g. the stomach, so that the attachment parts do not interfere or damage the lining of the mouth and/or the oesophagus. Prior to or during the transition to the second state the attachment parts may extend from the body parts and outwards, making the attachment parts ready to interact with a lining of the digestive system. When the attachment part or parts are in a folded or collapsed position, the distance from the central axis to the distal end of the attachment part being longer in the second state than in a first state. Thus, the diameter of the drug delivery device in the first state will be less in than the diameter of the drug delivery device in the second state.

In one or more exemplary drug delivery devices, at least part of the first attachment part and/or the second attachment part, such as the first needle and/or the second needle may be made of material comprising one or more of magnesium, titanium, iron and zinc which allows for accurate and precise control of the size and/or shape/geometry of the first attachment part and/or second attachment part in turn allowing for a delivery device with desired attachment capabilities and/or small production variances which is in particular important in the pharmaceutical industry.

The first attachment part, such as the first needle, may be made of material comprising one or more of magnesium, titanium, iron and zinc. The material of the first attachment part/first needle may be biocompatible and/or biodegradable such as a biocompatible material and/or a biodegradable material. The material of the first attachment part/first needle may comprise one or more biodegradable polymers such as PLA and/or POLGA. Some of, part of, most of, substantially all, or all of the material of the first attachment

part/first needle may be biocompatible and/or biodegradable. The material of the first attachment part, such as the first needle, may comprise, consist of, or essentially consist of, biocompatible and/or biodegradable material such as biocompatible and/or biodegradable metals. The material of the first attachment part, such as the first needle, 5 may comprise a biodegradable or bioresorbable metal or metal alloy, such as magnesium, zinc, and/or iron or an alloy comprising one or more of magnesium, zinc and iron. A biodegradable or bioresorbable metal or metal alloy may be understood as a metal or metal alloy that degrades safely within e.g. a human body in a practical amount of time, for example related to their application. The material of the first attachment part, such as 10 the first needle, may comprise one or more metals such as a combination of one or more metals e.g. as a metal alloy.

The second attachment part, such as the second needle, may be made of material comprising one or more of magnesium, titanium, iron and zinc. The material of the second attachment part/second needle may be biocompatible and/or biodegradable such as a 15 biocompatible material and/or a biodegradable material. The material of the second attachment part/second needle may comprise one or more biodegradable polymers such as PLA and/or POLGA. Some of, part of, most of, substantially all, or all of the material of the second attachment part/second needle may be biocompatible and/or biodegradable. The material of the second attachment part, such as the second needle, may comprise, 20 consist of, or essentially consist of, biocompatible and/or biodegradable material such as biocompatible and/or biodegradable metals. The material of the second attachment part, such as the second needle, may comprise a biodegradable or bioresorbable metal or metal alloy, such as magnesium, zinc, and/or iron or an alloy comprising one or more of magnesium, zinc and iron. A biodegradable or bioresorbable metal or metal alloy may be 25 understood as a metal or metal alloy that degrades safely within e.g. a human body in a practical amount of time, for example related to their application. The material of the second attachment part, such as the second needle, may comprise one or more metals such as a combination of one or more metals e.g. as a metal alloy.

An advantage of having a biodegradable material used in the attachment part(s) may be 30 that the delivery device is able to deliver an active drug substance or payload arranged in the attachment part(s) and/or body parts of the delivery device at a specific part of the body of the subject, e.g. such as the stomach or intestines after the delivery device has attached to the internal surface, e.g. the intestinal wall, thanks to the sharp properties of the material of the attachment part(s), and for an extended period of time, since the

biodegradable material will degrade gradually in time. Further, when the material of the attachment part(s) is biodegradable, the attachment part(s) will degrade in the human body and disappear after having delivered the payload/active drug substance comprised in the drug delivery device, thereby avoiding harming the human subject over time. The
5 attachment part(s) may be configured to degrade in a period of time of hours, e.g. 2 hours, 5 hours, 10 hours, 20 hours, or 24 hours, days, e.g. 1 day, 2 days, 5 days, or weeks, e.g. 1 week, 2 weeks, 3 weeks, or 5 weeks.

The material of the attachment part(s), such as the needle(s), may comprise one or more or a combination of magnesium (Mg), zinc (Zn), and/or iron (Fe). An advantage of having
10 the attachment part(s) of a material comprising Mg, Zn, and/or Fe may be that the shape and size of the attachment part(s) can be precisely controlled thereby providing improved attachment to the internal surface, for example to an internal wall of the intestines of the human subject.

The attachment part(s), such as the needle(s), may be made of a material comprising one
15 or more thermoplastic or thermoset polymers. The material of the attachment part(s), such as the needle(s), may comprise one or more active drug substances. Thus, an active drug substance may be embedded in the material of the attachment part(s), such as the needle(s), to form a pharmaceutical composition.

In some embodiments, the attachment part(s), such as the needle(s), may comprise for
20 example water soluble, water insoluble, biodegradable, non-biodegradable and/or pH dependent soluble materials. In some embodiments, the attachment part(s), such as the needle(s), may comprise a water soluble, biodegradable and/or pH-dependent material that may dissolve and/or degrade so that the attachment part(s), such as the needle(s), lodged in the intestinal tissue may gradually degrade and/or dissolve. In some
25 embodiments, the attachment part(s), such as the needle(s), may comprise a water-soluble material to allow immediate release or modified release of the active drug substance depending of the material selected. In some embodiments, a water insoluble or biodegradable material may allow depot of the active drug substance in the attachment part(s), such as the needle(s), for longer release duration (for example days, weeks or
30 months). In some embodiments, a pH dependent soluble material may allow the attachment part(s), such as the needle(s), to stay intact at pH conditions below the physiologic for example a pH of approximately 7.4 to remain intact in the gastrointestinal lumen, but then may dissolve once inside the gastrointestinal wall. In some embodiments,

one or more water soluble, water insoluble, biodegradable and/or pH dependent materials may optionally be combined to control release of the active drug substance for example by diffusion or erosion of the attachment part(s), such as the needle(s), for controlled release duration (for example minutes, hours, days, weeks, or months).

- 5 In some embodiments, the attachment part(s), such as the needle(s), may be made from different compositions. For example, an outer part of the attachment part(s), such as the needle(s), may be made of one composition and an inner core of the attachment part(s), such as the needle(s), may be made from another composition. In some embodiments, the outer part and the inner core of the attachment part(s), such as the needle(s), may be
10 composed of for example a water soluble, a water insoluble, a biodegradable, and/or a pH dependent material. In some embodiments, one or more water soluble, water insoluble, biodegradable and/or pH dependent materials may be combined to control the release of the active drug substance once the attachment part(s), such as the needle(s), may move its position from the lumen to the internal tissue for example the gastrointestinal lumen to
15 the gastrointestinal tissue.

- In some embodiments, the attachment part(s), such as the needle(s), may be tubular and may include a tubular body and the tubular body may comprise an active drug substance for example a liquid payload comprising the active drug substance, optionally connected to a tubular attachment part so the payload with the active drug substance may flow
20 through the attachment part(s), such as the needle(s), into the internal tissue for example the intestinal tissue. In some embodiments, the tubular body may contain expandable such as swelling excipients that may expand by a chemical reaction for example when mixed expand in volume and/or produce a gas to advance the delivery of the payload. In some embodiments, the expansion is by osmosis.

- 25 In some embodiments, the first compartment (compartment to hold active drug substance) may comprise a closure part for closing the first compartment. The closure part may contribute to improved control of release of the active drug substance. In some embodiments, the closure part may be composed of for example a water soluble, a water insoluble, a biodegradable, and/or a pH dependent material. In some embodiments, one
30 or more water soluble, water insoluble, biodegradable and/or pH dependent materials may be combined to control the release of the active drug substance from the first compartment once the attachment part(s), such as the needle(s), moves its position from

the lumen to the internal tissue for example from the gastrointestinal lumen to the gastrointestinal tissue.

Fig. 1 shows a diagram of an example drug delivery device having an offset actuator mechanism according to the disclosure. Certain components in Fig. 1 have been made
5 see-through for convenience of viewing certain internal structures.

As shown, a drug delivery device 10 can include a central axis 12. The central axis 12 can extend from a first longitudinal end 14 of the drug delivery device 10 to a second longitudinal end 16 of the drug delivery device 10. As shown in Fig. 1, the central axis 12 may be a longitudinal axis of the drug delivery device 10, though in certain
10 implementations may not be. The drug delivery device 10 can further include a first body part 18 and a second body part 20, as well as an attachment part 22 connected to the first body part 18. The attachment part 22 can be configured to provide an active drug substance. The attachment part 22 can include a spike 30 having a distal tip 32. The distal tip 32 can be directed non-parallel to the central axis 12, such as shown in Fig. 1.
15 Alternatively, it may be directed parallel to the central axis 12. Optionally, the first body part 18 can form a portion of the first longitudinal 14 and/or the second body part 20 can form a portion of the second longitudinal end 16.

The drug delivery device 10 can further include an actuator mechanism 24. The actuator mechanism 24 may optionally include a resilient part. The actuator mechanism 24 can be
20 configured to rotate one of the first body part 18 and the second body part 20. The actuator mechanism 22 can be located more towards the first longitudinal end 14 than the second longitudinal end 16 along the central axis 12. For example, as shown the actuator mechanism 22 may be offset from a center of the drug delivery device 10. The actuator mechanism 22 may be offset a number of ways, as discussed herein.

25 Fig. 1 shows the central axis 12 being a longitudinal axis of the drug delivery device 10, however other axes can be used as well.

As shown in Fig. 1, the actuator mechanism 24 can be located fully within the first body part 18. Alternatively, the actuator mechanism 24 can be located partially within the first body part 18, or fully within the second body part 20. For example, the actuator
30 mechanism 24 can be located partially within the first body part 18 and partially within the second body part 20. These approaches may offset the actuator mechanism 24.

Further, as shown in Fig. 1, the actuator mechanism 24 can be located more towards the first longitudinal end 14 than the attachment part 22. Moreover, as shown, the actuator mechanism 24 can be centered on the central axis 12. For example, the central axis 12 passes through a center of the actuator mechanism 22, as shown. Alternatively, the
5 actuator mechanism 24 can be offset from the central axis 12 (such as more towards a radial side) as well as being offset longitudinally.

Fig. 2 illustrates a diagram of an example drug delivery device having an offset actuator mechanism according to the disclosure. The drug delivery device 10A of Fig. 2 can include any and/or all of the features of the drug delivery device 10 of Fig. 1.

10 As shown, the drug delivery device 10A can optionally include a second attachment part 26 connected to the second body part 20. The second attachment part 26 and the attachment part 22 can have a particular separation 28. The second attachment part 26 and the attachment part 22 can have a separation 28 of 0-10mm. For example, the second attachment part 26 and the attachment part 22 can be within 10mm of each other
15 along the central axis 12, e.g., they can have a separation 28 of 10mm or less. The second attachment part 26 and the attachment part 22 can be within 4.1mm of each other along the central axis 12, e.g., they can have a separation 28 of 4.1mm or less. The second attachment part 26 and the attachment part 22 can be within 3.9mm of each other along the central axis 12, e.g., they can have a separation 28 of 3.9mm or less. As shown
20 in Fig. 2, the separation 28 can be measured from distal tips of the attachment part 22 and the second attachment part 26, though other separations can be used as well.

Advantageously, the drug delivery device 10A can have a reduced size. For example, the drug delivery device 10A can be a 000 size capsule. The drug delivery device 10A can be a 00 size capsule. The drug delivery device 10A can be a 0 size capsule.

25 Fig. 3 illustrates a diagram of an example drug delivery device having an offset actuator mechanism according to the disclosure. The drug delivery device 10B of Fig. 3 can include any and/or all of the features of the drug delivery device 10 of Fig. 1 and/or any and/or all of the features of the drug delivery device 10A of Fig. 2.

Also disclosed are delivery devices, methods, and compositions according to any of the
30 following items.

Item 1. A drug delivery device comprising:

a central axis extending from a first longitudinal end of the drug delivery device to a second longitudinal end of the drug delivery device;

a first body part;

a second body part;

5 an attachment part connected to the first body part; and

an actuator mechanism configured to rotate one of the first body part and the second body part, wherein the actuator mechanism is located more towards the first longitudinal end than the second longitudinal end along the central axis.

Item 2. Drug delivery device of Item 1, wherein the actuator mechanism is located fully
10 within the first body part.

Item 3. Drug delivery device of any one of the preceding Items, wherein the actuator mechanism is located partially within the first body part and partially within the second body part.

Item 4. Drug delivery device of any one of the preceding Items, wherein the actuator
15 mechanism is located more towards the first longitudinal end than the attachment part.

Item 5. Drug delivery device of any one of the preceding Items, wherein the actuator mechanism is centered on the central axis.

Item 6. Drug delivery device of any one of the preceding Items, further comprising a second attachment part connected to the second body.

20 Item 7. Drug delivery device of Item 6, wherein the second attachment part and the attachment part are within 10mm of each other along the central axis.

Item 8. Drug delivery device of Item 6, wherein the second attachment part and the attachment part are within 4.1mm of each other along the central axis.

Item 9. Drug delivery device of Item 6, wherein the second attachment part and the
25 attachment part are within 3.9mm of each other along the central axis.

Item 10. Drug delivery device of any one of the preceding Items, wherein the drug delivery device is a 000 size capsule.

Item 11. Drug delivery device of any one of the preceding Items, wherein the drug delivery device is a 00 size capsule.

Item 12. Drug delivery device of any one of the preceding Items, wherein the drug delivery device is a 0 size capsule.

- 5 Item 13. Drug delivery device of any one of the preceding Items, wherein the attachment part is configured to provide an active drug substance.

Item 14. Drug delivery device of any one of the preceding Items, wherein the actuator mechanism comprises a resilient part.

- Item 15. Drug delivery device of any one of the preceding Items, wherein the attachment
10 part comprises a spike having a distal tip directed non-parallel to the central axis.

Item 16. Drug delivery device of any one of the preceding Items, wherein the first body part forms a portion of the first longitudinal end and/or the second body part forms a portion of the second longitudinal end.

- The use of the terms "first", "second", "third" and "fourth", "primary", "secondary", "tertiary"
15 etc. does not imply any particular order, but are included to identify individual elements. Moreover, the use of the terms "first", "second", "third" and "fourth", "primary", "secondary", "tertiary" etc. does not denote any order or importance, but rather the terms "first", "second", "third" and "fourth", "primary", "secondary", "tertiary" etc. are used to distinguish one element from another. Note that the words "first", "second", "third" and
20 "fourth", "primary", "secondary", "tertiary" etc. are used here and elsewhere for labelling purposes only and are not intended to denote any specific spatial or temporal ordering.

Furthermore, the labelling of a first element does not imply the presence of a second element and vice versa.

- It is to be noted that the word "comprising" does not necessarily exclude the presence of
25 other elements or steps than those listed.

It is to be noted that the words "a" or "an" preceding an element do not exclude the presence of a plurality of such elements.

It should further be noted that any reference signs do not limit the scope of the claims, that the exemplary embodiments may be implemented at least in part by means of both hardware and software, and that several "means", "units" or "devices" may be represented by the same item of hardware.

- 5 Although features have been shown and described, it will be understood that they are not intended to limit the claimed invention, and it will be made obvious to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the claimed invention. The specification and drawings are, accordingly to be regarded in an illustrative rather than restrictive sense. The claimed invention is intended
- 10 to cover all alternatives, modifications, and equivalents.

LIST OF REFERENCES

10, 10A, 10B	drug delivery device
12	central axis
14	first longitudinal end
5 16	second longitudinal end
18	first body part
20	second body part
22	attachment part
24	actuator mechanism
10 26	second attachment part
28	separation
30	spike
32	distal tip

CLAIMS

1. A drug delivery device (10, 10A, 10B) comprising:

a central axis (12) extending from a first longitudinal end (14) of the drug delivery device (10, 10A, 10B) to a second longitudinal end (16) of the drug delivery device (10,
5 10A, 10B);

a first body part (18);

a second body part (20);

an attachment part (22) connected to the first body part (18); and

an actuator mechanism (24) configured to rotate one of the first body part (18) and
10 the second body part (20), wherein the actuator mechanism (24) is located more towards the first longitudinal end (14) than the second longitudinal end (16) along the central axis (12);

characterized in that the actuator mechanism (24) is located more towards the first longitudinal end (14) than the attachment part (22).

15 2. Drug delivery device of claim 1, wherein the actuator mechanism (24) is located fully within the first body part (18).

3. Drug delivery device of claim 1, wherein the actuator mechanism (24) is located partially within the first body part (18) and partially within the second body part (20).

4. Drug delivery device of any one of the preceding claims, wherein the actuator
20 mechanism (24) is centered on the central axis (12).

5. Drug delivery device of any one of the preceding claims, further comprising a second attachment part (26) connected to the second body part (20).

6. Drug delivery device of claim 5, wherein the second attachment part (26) and the attachment part (22) are within 10mm of each other along the central axis (12).
7. Drug delivery device of claim 5, wherein the second attachment part (26) and the attachment part (22) are within 4.1mm of each other along the central axis (12).
- 5 8. Drug delivery device of claim 5, wherein the second attachment part (26) and the attachment part (22) are within 3.9mm of each other along the central axis (12).
9. Drug delivery device of any one of the preceding claims, wherein the drug delivery device (10, 10A, 10B) is a 000 size capsule.
- 10 10. Drug delivery device of any one of the preceding claims, wherein the drug delivery device (10, 10A, 10B) is a 00 size capsule.
11. Drug delivery device of any one of the preceding claims, wherein the drug delivery device (10, 10A, 10B) is a 0 size capsule.
12. Drug delivery device of any one of the preceding claims, wherein the attachment part (22) is configured to provide an active drug substance.
- 15 13. Drug delivery device of any one of the preceding claims, wherein the actuator mechanism (24) comprises a resilient part.
14. Drug delivery device of any one of the preceding claims, wherein the attachment part (22) comprises a spike (30) having a distal tip (32) directed non-parallel to the central axis (12).
- 20 15. Drug delivery device of any one of the preceding claims, wherein the first body part (18) forms a portion of the first longitudinal end (14) and/or the second body part (20) forms a portion of the second longitudinal end (16).