# Universally applicable cell collecting device

The present invention relates to a universally applicable device for collecting cells or other biological material for examination thereof, comprising a handle having on one of its ends a carrier with cell receiving means.

The only embodiment of such a device which has reached practice is the cotton bud in which a wooden, plastic or metal stick carries a cotton tip as cell receiving means. This cotton tip has the disadvantage that humid cells are absorbed within the cotton and are not easily delivered again. Furthermore, the tip can sometimes fully or partially stay behind in the cell collecting spot where it can give rise to inflammations and in case it stays behind in body cavities, such as the urethra, the remainders in some cases can only be removed by surgery.

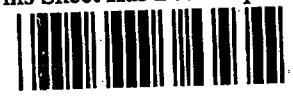
In the literature several alternatives are proposed which, however, have still not resulted in a practically suitable and reliable cell collecting device.

It is therefore the object of the present invention to provide a universally applicable cell collecting device in which the problems described above are removed in an effective way.

To obtain this object the device of the type mentioned in the preamble is characterized according to the invention in that the cell receiving means comprises substantially parallel plastic bristles together forming a brush head and one end of which being fixed on the carrier, the bristles being positioned such that the cross dimensions of the brush head is substantially equal in all directions.

By using plastic bristles, wet or humid cells are not absorbed so that they can easily be delivered again in order to be examined. Furthermore, the shape of the brush head makes the device suitable for various uses, both in cavities and on the body surface. Of course a circular outer circumference of the carrier and brush offers the best possibilities for universal application, but it is also conceivable that said shapes are slightly adapted for different purposes and consequently also include oval, square or similar shapes.

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To further improve the cell receipt capacity it is favourable if the cross-section of at least a part of the bristles include a larger and smaller dimension, and wherein the larger dimension is orientated in circumferential direction of the brush head, of which in the preferred embodiment the bristles include two scraping edges positioned on the tangential sides of the bristles as seen in relation to the rotational axis of the device.

In this embodiment, the scraping action of the bristles is only activated if the brush is deformed. For example, when cells are collected from a cavity the bristles will be inactive upon insertion and removal and only when the brush head is rotated the torsion of the bristles will cause their scraping edges to be oriented outwardly thereby being able to scrape cells from the wall. Upon removal of the brush head from the body cavity, the bristles will move back to the inactive position and in this way it is prevented that cells or other biological material collected on the scraping edges are given back to the wall of the cavity. In this manner, great and representative amounts of cells, body fluids or micro-organisms may therefore be gathered. The scraping edges of the bristles may also be activated by pushing the free end of the brush head against the end of the body cavity causing the brush to bulge outwardly and thereby permitting the scraping edges of the bristles to become effective. Also the deformation against a flat surface can make the scraping edges active. In relation to the term scraping edges it is noted that these edges should not be completely sharp but may also be rounded. One may also speak of scraping edges with bristles having an elliptical or oval-shaped cross-section.

To further reduce the risk of trauma upon insertion and removal of the bristle head of the device into and out of a body cavity it may be an advantage when the bristles positioned on the circumference of the brush head are of such cross-section that they form a substantially smooth cylinder-shaped outer circumference of the brush head. This can be realized, for example, in that the circumference of the bristles is defined by two circular segments having different radius of curvature and joining each other at an acute angle. In this case, the radius of curvature of the circular segment

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...ch hair, which is positioned on the circumference of the ...h head will correspond to the radius of curvature of the ...ole brush head.

A very advantageous embodiment of the device according to the invention is characterized in that the outer circumference of the brush head defined by the bristles is conical from the carrier towards the free end. In this manner, the introduction of the brush head into a body cavity is facilitated on one hand, while also the introduction of the brush head into a receptacle containing transport medium is simplified, or the diameter of the transport medium receptacle may be decreased causing the volume of the receptacle to be reduced leading to a saving of transport medium, on the other hand.

The invention will hereafter be elucidated with reference to the drawing showing an embodiment of the device according to the invention schematically by way of example.

Fig. 1 is a side view of an exemplary embodiment of the cell collecting device according to the invention.

Fig. 2 is an enlarged plan view of the device of Fig. 1 wherein, as in Fig. 3, the bristles of the brush head of the device are drawn parallel to each other for the sake of clarity.

Fig. 3 is a sectional view along the line III-III in Fig. 2, in which the handle of the device is omitted.

Fig. 4, 5, 6 show the bristles IV, V and VI of Fig. 3 on an enlarged scale.

The drawing shows exemplary embodiments of a device for scraping and collecting body cells, and body fluids and for collecting intra and extra cellular micro-organisms.

As shown in Fig. 1, the device includes an elongate straight plastic handle 1 on one end of which a carrier 2 having a brush head 3 is removable attached. The brush head 3 includes in this embodiment a plurality of bristles 4 extending substantially parallel to the longitudinal axis of the handle 1 and being fixed on one end to the carrier 2 with a uniform distribution. The carrier 2 and the bristles 4 are integral and made of plastic, such as for instance polyethylene Exxon LDPE 653, by injection moulding. Of course also other materials and other production techniques may be

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used.

As shown in Fig. 1, at least the bristles positioned at the circumference of the brush head 3 extend from the carrier 2 conically or tapered so that the brush head 3 has the form of a tapered cone having a smooth outer wall.

For the sake of simplicity Fig. 2 and 3 show the bristles 4 parallel to each other, but in practice the bristles will extend in accordance with Fig. 1.

Referring to Fig. 2, the bristles are arranged in three circular rows around the centre of the carrier 2, the bristles 4' being the thickest ones and the bristles 4'' and 4''' in the rows towards the outer circumference are progressively thinner. This is clearly shown in Fig. 4-6. The number of bristles in a circular row increases towards the outer circumference. The cross-section of the bristles consist of two circular segments having a larger and smaller radius of curvature, wherein both circular segments join each other at an acute angle as a more or less sharp edge indicated as scraping edge 5 (Fig. 4-6). The radius of curvature of the circular segment at the outer circumference of the respective row of bristles 4', 4'', 4''', and in particular at the outer circumference of the brush head 3, corresponds to the radius of curvature of the brush head 3 in its entirety. This is clearly shown in Fig. 2. The cross-section of the bristles 4 is equal along the full length, but it would of course also be conceivable that the bristles taper towards their free end. The centrally positioned bristles 4' are not only thicker but also longer than the bristles 4'' positioned outwardly thereof and the bristles 4''' in turn positioned outwardly of these. This makes it possible that the brush head 3 tapers to a point on the free end, which facilitates the introduction into cavities. Since the bristles 4' near the centre of the carrier 2 are thicker than those outwardly thereof, these bristles 4' effect a rigidification in the centre of the brush head 3.

When the device has collected cells, body fluids or intra and extra cellular micro-organisms, these may selectively be directly smeared onto a slide for microscopic examination and on culture medium for microbiologic cultures, or be put into a receptacle containing preserving or transport medium in order to be transported to a laboratory. Then the

handle 1 is separated from the carrier 2 and brush head 3.

The device according to the invention as described above and shown in the drawing offers many advantages. First of all, large amounts of cells are collected (typical endocervical cells in endocervical samplings). The device may also be introduced into all kinds of body openings so that the device according to the invention may replace the usual cotton bud in nose and throat sampling, in anal, vaginal and cervical samplings and for microbial isolation with skin diseases. Samples may also be taken from surgical wounds or the like. Based thereon, the device according to the invention is applicable both in the microbiology, cytopathology and in PCR technology, so that one can actually speak of a universally applicable cell collecting device.

The invention is not restricted to the embodiment shown in the drawing and described above, which may be varied in different manners within the scope of the invention. The bristles of the brush head may for instance be formed on the carrier in all kinds of other arrangements. For example, the bristles may be arranged symmetrically, as seen in circumferential direction of the carrier, and may also be suited for a rotation of the device in one direction, this in contradiction to the embodiment shown which is operational in opposite rotational directions. Also the cross-section of the bristles may be varied and may include for example rectangular, square or other polygonal shapes, and also round, oval or other shapes and mixtures thereof are conceivable with or without the formation of one or more scraping edges. The term bristle is used herein to indicate that the cell collecting means are elongate and elastically bendable and together forming a bristle or pencil-shaped head. The flexibility of the bristles will generally be such that a deformation is possible without excessive forces, but the brush head will have a certain rigidity in longitudinal direction in order to assist in a proper introduction into body cavities.

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## CLAIMS

1. Universally applicable device for collecting cells or other biological material for examination thereof, comprising a handle (1) having on one of its ends a carrier (2) with cell receiving means (4), **characterized** in that the cell receiving means (4) comprises substantially parallel plastic bristles (4) together forming a brush head (3) and one end of which being fixed on the carrier (2), the bristles being positioned such that the cross dimensions of the brush head (3) is substantially equal in all directions.

2. Device according to claim 1, wherein the brush head (3) and the carrier (2) are of substantially round cross-section.

3. Device according to claim 1 or 2, wherein the bristles (4) are uniformly distributed over the carrier (2) in circumferential direction.

4. Device according to claim 1, 2 or 3, wherein the cross-section of at least a part of the bristles (4) include a larger and smaller dimension, and wherein the larger dimension is orientated in circumferential direction of the brush head (3).

5. Device according to claim 4, wherein the bristles positioned on the circumference of the brush head (3) are of such cross-section that they form a substantially smooth cylinder-shaped outer circumference of the brush head (3).

6. Device according to one of the preceding claims, wherein the outer circumference of the brush head (3) defined by the bristles (4) is conical from the carrier (2) towards the free end.

7. Device according to claim 6, wherein the cross centre of the carrier (2) is without bristles (4).

8. Device according to one of the preceding claims, wherein the bristles (4''') positioned on the outer circumference of the brush head (3) are thinner and shorter than the other bristles (4'' and 4').

9. Device according to one of the preceding claims, wherein the bristles (4) include at least one longitudinal scraping edge (5).



10. Device according to one of claims 4 or 5 and 9, wherein the bristles (4) include two scraping edges (5) positioned on the tangential sides of the bristles as seen in relation to the rotational axis of the device.

11. Device according to claim 10, wherein the bristles (4) are symmetrically in relation to a respective radial line of the brush head (3).

12. Device according to claim 10 or 11, wherein the circumference of the bristles (4) is defined by two circular segments having different radius of curvature and joining each other at an acute angle.

13. Device according to one of the preceding claims, wherein the bristles (4) are directed substantially in longitudinal direction of the handle (1).

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