Lecture: alternatives & education

Novel test lung for real life supported simulation

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Ventilation methods are gaining more importance in the areas of intensive care (Oczenski et al., 1997) and veterinary medicine. In Austria for the *in vivo* implementation a variety of many engineering standards (DIN, 1997; 1998; 2004) have to be accomplished, in addition the consent of the ethics commission has to be given.

In many cases the accomplishment of these engineering standards presume animal testing. Other tests, for example the artificial application of harmful substances and toxins, are as a matter of principle not conducted *in vivo* on humans. The multifariousness in harmful substances range from air pollution and to fractionally self-applied substances. Realizing the complexity of inhaling dangerous substances on its own is often not enough to estimate the future health implications. In addition, the allocation of those substances in the lung has to be carefully examined. Hence, allocation measurements and analysis in health engineering are obligated. To realize these measurements artificial lung systems are implemented.

Artificial lung systems vary from passive to almost lifelike active ones. Passive systems usually only reflect few aspects of real lung functions. Constructive breathing bags or springs induce thermally stabilized passive lung systems with usually few lifelike characteristics.

Today new ventilation technologies, which are summarized by the umbrella term of lung protective ventilation, and rapid enhancement of computer technology enable later on substantially technological progress in design and implementation of artificial lung systems. These systems were created with the ability to measure pressure, volume and flow and then use those measurements in a mathematical lung model, calculating the output required to drive the mechanical lung.

Finally, despite the rapid enhancement of computer technology mechanical lung systems can not completely mirror *in vivo* measurements, because the biological lung structure due to its very complex construction is nearly impossible to artificially duplicate. To negotiate this serious drawback we constructed an active lung which central heart is a real pig lung.

In the area of development and research our construction and configuration can measure and analyse harmful substances and toxins *in vivo* lungs. Within those accomplishments it is possible for us to implement those essential measurements, which until now have been executed on still living animals, in a laboratory with the artificial lung. The applied pig lungs were exclusively used from animal for slaughter and afterwards for our applications prepared. There is a special focus in the close to reality simulation to create lifelike respiration procedures.

We present a novel test lung for real life supported simulation. First this special set up can perform the natural functionality of a passive lung, second under adequate respiration conditions and third in gasping mode. In order to provide various breathing patterns a pneumatics based driving system has been designed. The test lung consists of the “lung” itself (a breathing bag or a preserved pig lung) and a Perspex-lined box enabling a free view on the test–lung from outside for the purpose of demonstration in education and traineeship.

References

DIN (1997-2004). DIN EN 794-3:1998-10/A1:2005-02 ; DIN EN 50103:1997-04 ; DIN EN ISO 10651-2:2004-10; DIN EN ISO 10651-6:2004-10

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