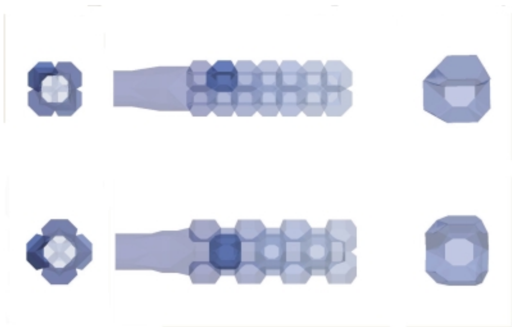

Fig. 5. A single alveolus in the straight alveolar duct model around FRC. Upper: the same view as in Fig. 4. Lower: rotated view at 45 degree around the longitudinal axis.

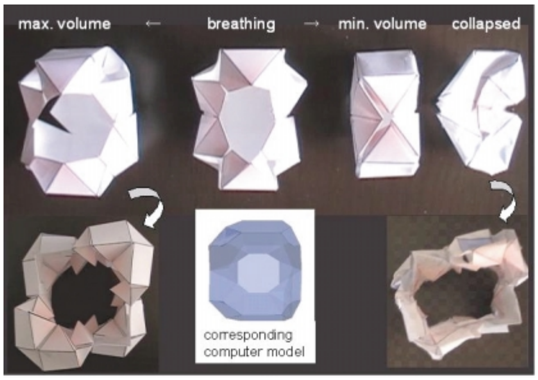

Fig. 6. Origami models for single alveolus (upper row) and alveolar duct unit (lower row). An Origami alveolus changes its shape and volume by changing folds in the mouth colored pink. An Origami alveolar duct is constructed by combining those alveoli. When all alveoli in the duct unit are collapsed, the duct unit looks as if one single alveolus had thickened alveolar wall (right end pictures).

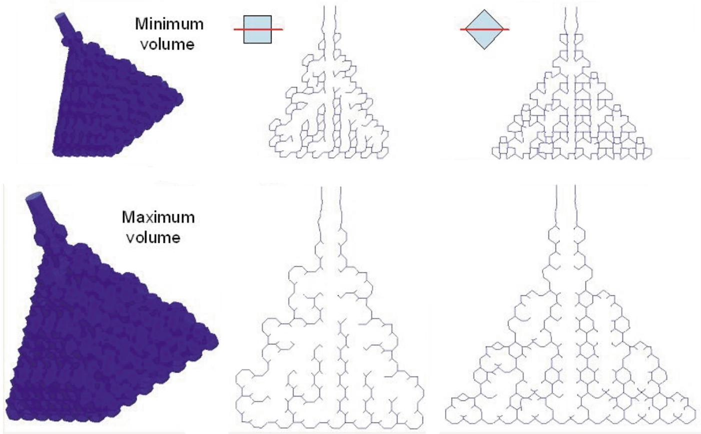

Fig. 7. Pyramid-shaped subacinar model consisting of 1,200 alveoli.

filling air pathway. A straight alveolar duct model is the minimum alveolar system in which several duct units are arranged in line. An alveolar duct unit is modeled as a deformed cubic column in which eight alveoli are contained as shown in Fig. 4. A single alveolus is a part of 18-polyhedron whose mouth is opened to the duct space as shown in Fig. 5.

The 18-polyhedron is made from a hexahedron by shaving 12 edges into hexagons, with which the face number increases from 6 to 18. The alveolar mouth shown in Fig. 5 is widened and narrowed during breathing motion as experimentally investigated in animal lungs (Mercer *et al.*, 1987; Kitaoka *et al.*, 2007). Since 80% of elastin fibers in the alveolar wall are distributed at the alveolar mouths (Mercer and Crapo, 1990), alveolar mouth is much more deformable than other part of alveolar walls (Mercer *et al.*, 1987).

The present author previously proposed simple Origami models for the alveolar system starting from square sheets (Kitaoka *et al.*, 2010). However, it was impossible to fill the space by those models. The present author has improved the Origami models so as to be nearly equivalent to the computer models, as indicated in Fig. 6. The Origami sheets and the method for making the Origami model are given in the manual (http://www7b.biglobe.ne.jp/∼lung4cer/origamiManualE.pdf).

One can make and handle the model in reality. As the alveolar mouth is folded up, inner diameter of the alveolar duct become smaller, because dihedral angles between walls become smaller. When the alveolar mouth is completely folded, the mouth is closed and the alveolar duct volume reaches the minimum. One can feel the airflow on his palm while contracting the model with his both hands. Furthermore, the Origami model helps to understand the structural change in alveolar collapse as shown in Fig. 6. In the Origami model, collapsed alveolar walls are irregularly folded up as if one single wall were thickened. In addition, the open alveolar duct looks as if one single alveolus were surrounded by thickened alveolar wall. This misinterpretation is the same as the description of histologic findings of diffuse alveolar damage (DAD) in conventional textbooks (Katzenstein and Akin, 1990).

There are two different points between the computer model and the Origami model: One is that the mouth in the Origami alveolar model is not contracted but folded. However, if folding interval is very small, it behaves like an