alveoli are situated immediately adjacent to small bronchi. While cleansing of these probably would be more readily accomplished by the interstitial route proposed, this route does not seem as likely for the majority of spaces which really are as much as 2 or 3 mm from any ciliated epithelium. Green replied that when three dimensional anatomy is observed, shorter routes along the alveolar septi are noted.

A. Brody asked whether a gradient of flow there could be due to a valve-like effect created at the entrance to the bronchioles by directed ciliary action. Green knew of no evidence in support of this.

Lourenço pointed out the difficulty in assessing direction of movement from still pictures and questioned the mechanisms necessary for the propulsion of the alveolar macrophages along peribroncholar “tethers.” He also questioned the relative importance of the mechanism of alveolar-broncholar transport described by Green in relation to other mechanisms such as lymphatic drainage and mucociliary clearance.

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### Regional Aerosol Clearance in Smokers and Nonsmokers

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In order to study the effects of a repeated smoking exposure on clearance of inhaled aerosol from the lung, retention of $^{131}$I human serum albumin (HSA) aerosol (mass median diameter 3 $\mu$, range 1-10 $\mu$) was followed with respect to time in nine smokers who inhaled a cigarette every 15-20 minutes and ten nonsmokers. Smokers were not bronchitic (M.R.C. bronchitis questionnaire) and had normal pulmonary function tests (VC, FRC, RV, FEV, $D_{150}$, mixing).

Regional retention of activity was followed for up to 25 hours by means of an Anger scintillation camera—multichannel analyzer—computer system for 40 x 2.5 cm squares grouped into three crescentic areas around the hilus of the right lung. The peripheral and intermediate areas were each 2.5 cm wide while the inner or perihilar area was 5-7.5 cm wide. Subjects did not smoke for one hour prior to inhalation of aerosol. The thyroid gland was blocked with Lugol’s iodine.

Subjects were carefully positioned during data collection using light pointers focused on chest markers. In normals, clearance curves for the perihilar area (reflecting ciliated major airways) gave a first phase T% of 42 minutes, and a second phase T% of 22 hours. Intermediate area T% was 22 hours. After a small initial increase in activity for about one hour, outer region clearance proceeded with a T% of 22 hours as before.

Smokers had quite different results. Perihilar region showed little change for 1½-2 hours, then cleared with a first phase T% of 2.3 hours and a second phase T% of 13 hours. Middle and peripheral regions had identical T% values.

After 24 hours, average lung retention of activity was approximately 50 percent in normals, but less than 25 percent in smokers suggesting a failure of small aerosol droplets ($<3\mu$) to reach the peripheral or slow phase airways and probably accounting, in smokers, for the absence of the typical peripheral region curve with its very slow clearance, as well as explaining the peripheral attenuation or pruning of activity seen in scintiphotographs. Paradoxically, while overall clearance of activity from the lung was faster in smokers, the clearance rate in the large proximal airways was slower than normal (T% 23 hours smokers; T% 42 minutes normals), while that more peripherally was faster. This probably explains the relative accumulation of activity in the perihilar region in many of the smokers at 1½-2 hours—a “log-jam” effect. The more rapid overall clearance in smokers is readily explained by the abnormal deposition invariably seen, there being much less aerosol deposited on presumably non-ciliated airways, emphasizing the importance of deposition pattern in determining clearance rates.

It is suggested that in addition to providing information about mucociliary function, this technique may also be a fairly sensitive means of assessing small airways obstruction in otherwise healthy young smokers.

**Discussion**

Lourenço mentioned the difficulty in comparing two different groups (laboratory workers of both sexes and nurses) who had been subjected to a different protocol (smoking and nonsmoking during test). Newhouse stated that nonsmokers did not smoke during the experiment; he did not feel that it would be possible, even though Lourenço thought it would be interesting. Newhouse stated further that far less material remains in the periphery in smokers than in nonsmokers in the first 24 hours. He postulated a mechanism whereby material deposited peripherally is whisked away more quickly in smokers than in nonsmokers. It was also suggested that smokers could be used as their own controls; such studies were already underway.

Lourenço presented data showing slower clearance of inhaled particles in smokers than in nonsmokers; however, neither group of subjects smoked during the study of clearance.