Aspergillus in pepper

SIR,—De Bock[1] and Vargas[2] and their co-workers expressed concern over contamination of dietary pepper with *Aspergillus* spp as a potential risk of aspergillosis to neutropenic patients. The source of a recent outbreak of pulmonary aspergillosis in over 40 bone-marrow transplant recipients at University College Hospital[3] was not clearly identified. Building work was proceeding on the top floor of the building housing the haematology unit, and the weather was hot and dry during the outbreak. Air sampling throughout the building and in patients' rooms revealed unexpectedly low counts of *Aspergillus* spp. Following the initial reports[1,2] we investigated the use of cruets in the leukaemia ward. We found that the practice in general wards was being followed in this unit: one salt and one pepper pot were taken from a batch in the kitchen and placed on the patient's tray just before delivery to the room. The pots were returned to the pool after use and were not cleaned unless overtly contaminated. The pots were refilled from stock when empty, without cleaning out old residues.

Pepper samples were cultured from 8 of 14 pepper pots on the haematological unit by shaking the pepper pots twice onto Sabouraud's agar. 7 of the 8 were contaminated with between 12 and 95 colonies of fungi from a mean inoculum of 22 mg of pepper. Fungi were identified as *Aspergillus flavus* (proportion of colonies 48 [SD 16]%), *A niger* (24 [13]%), *A fumigatus* (16 [11]%), and *Paecilomyces* sp (13 [10]%). Similar numbers of *Bacillus* spp were also isolated on blood agar. 3 sealed stock pepper pots also proved contaminated to a similar extent with the same fungal species. This contamination rate represents a three-fold greater rate than the 28% of pepper pots Vargas et al[2] described.

Aspergillus infections are presumed to be acquired by inhalation of spores, the airborne count of which will be raised transiently after shaking contaminated pepper. To test the degree of air contamination after shaking pepper pots, a heavily contaminated sample of pepper yielding 120 colony-forming units (cfu) of *Aspergillus* spp after a single shake was used. The pot was shaken onto a plate in relation to a slit sampler placed at about the same level as the nose of a patient when eating. The environmental air was free of aspergillus. Two shakes yielded *Aspergillus* spp 6 cfu/m^3 but 4, 8, and 16 shakes yielded 40, 39, and 40 cfu/m^3, respectively. Most of these organisms were introduced onto the plate only during the first 10 s after shaking, suggesting that formation of a permanent dust heavily contaminated with aspergillus was unlikely.

There is no direct evidence that pepper contamination is a source of risk for immunocompromised patients. However, it seems prudent to serve only autoclaved pepper to neutropenic patients,[1] or to use pepper in sachets,[2] which in Vargas and co-workers' study showed only a 3% contamination rate. In addition, our use of individual sachets of salt and pepper has removed the risk associated with redistribution of cruet sets from one patient in protective isolation to another without any attempt at decontamination.

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Fractals and retinal vessels

SIR,—Fractal geometry characterises several complex structures in nature[1] and a *Lancet* editorial has discussed the fractal structure of the retinal vessels. Knowledge of the development of retinal vessels and their disorders (eg, retinopathy of prematurity) is important not only for the ophthalmologist but also for the neuroscientist. The inner surface of the retina corresponds embryologically to the pial surface of the brain over which the initial formation of the cerebral vessels takes place.

I have investigated the fractal dimensions of vessel patterns in the embryonic cat retina (obtained from indian-ink filling pictures[2]) at embryonic days (E) 52, 55, and 57. I have also studied the adult human retina by wide-angle fundus photography. I used the density-density correlation function method,[3] the digitising of the pictures being automated by a scanner and self-written software. The calculations were done on a convex vector computer. The linear density-density correlation function characterises fractal geometry.[3] The fractal dimensions were calculated as 1·844 ($r^2 = 0·989$) for E52, 1·842 ($r^2 = 0·98$) for E55, and 1·825 ($r^2 = 0·987$) for E57—in other words, the fractal dimension does not change significantly during embryonic development. The fractal dimension for the adult human retinal vessel pattern was 1·875 ($r^2 = 0·952$), a value in agreement with the results of Masters,[4] who calculated values of 1·82, 1·82, and 1·88. The images of feline embryonic retinal vessel patterns[2] and those of adult man are very different, yet the fractal dimensions show, surprisingly, hardly any difference.

These results suggest that there is a "superior organisation principle" of the retinal vessel patterns that can be characterised excellently by only one universal fractal dimension of D = 1·84 (SD 0·025). This value is in agreement with Stark's results;[5] he had presented an "invasion percolation model" to explain drainage networks (D = 1·896). In contrast to other vascular systems, that normally have three-dimensional spreading capability, the retinal vascular system is more comparable with the geographer's stream systems and two-dimensional spreading behaviour.

In contrast, Mainster[6] had suggested diffusion-limited aggregation model with a fractal dimension of 1·66/1·67[3] for the organisation of the adult retinal vessels. Mainster calculated the fractal dimension of adult human retinal vessels, by a very different method, as 1·63/1·71. However, the method used gives lower values than the density-density correlation method.[5]

Formation of the retinal vascular system is thought to be regulated by the maturation and energy consumption of the photoreceptors.[7] The suggested underlying general fractal organisation principle, following an invasion percolation model that is valid for stream networks,[5] probably guarantees the best drainage and nutritional conditions at all stages in the development of retinal tissue.

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Fractal electroencephalography

SIR,—Your Dec 7 editorial showed how the principles of fractal analysis are being applied to research in various biomedical disciplines and indicated their future clinical value in the evaluation of complex or irregular data sets that defy interpretation by conventional analytic tools. Another potential application relates to bioelectrical signals, such as the electroencephalogram (EEG).

Fractal analysis of time-series data derived from EEG recordings has been computationally feasible since the mid-1980s, and the fractal dimensions of EEG signals have been independently estimated by several research groups in Europe, Asia, and (predominantly) the USA.[1] The results of these studies may be construed as broadly analogous to the results of research (cited in your editorial) by Goldberger et al on the electrocardiographic signal. The EEG also seems to have fractal properties which are sensitive to the clinical state of the patient.[2] Indeed, preliminary studies have aroused hopes that fractal dimension may be a more relevant index of neuropsychological status than any of the univariate descriptors of EEG activity traditionally derived from spectral analysis.[3] Changes in fractal dimension have already been described in association with a diverse range of neuropsychological