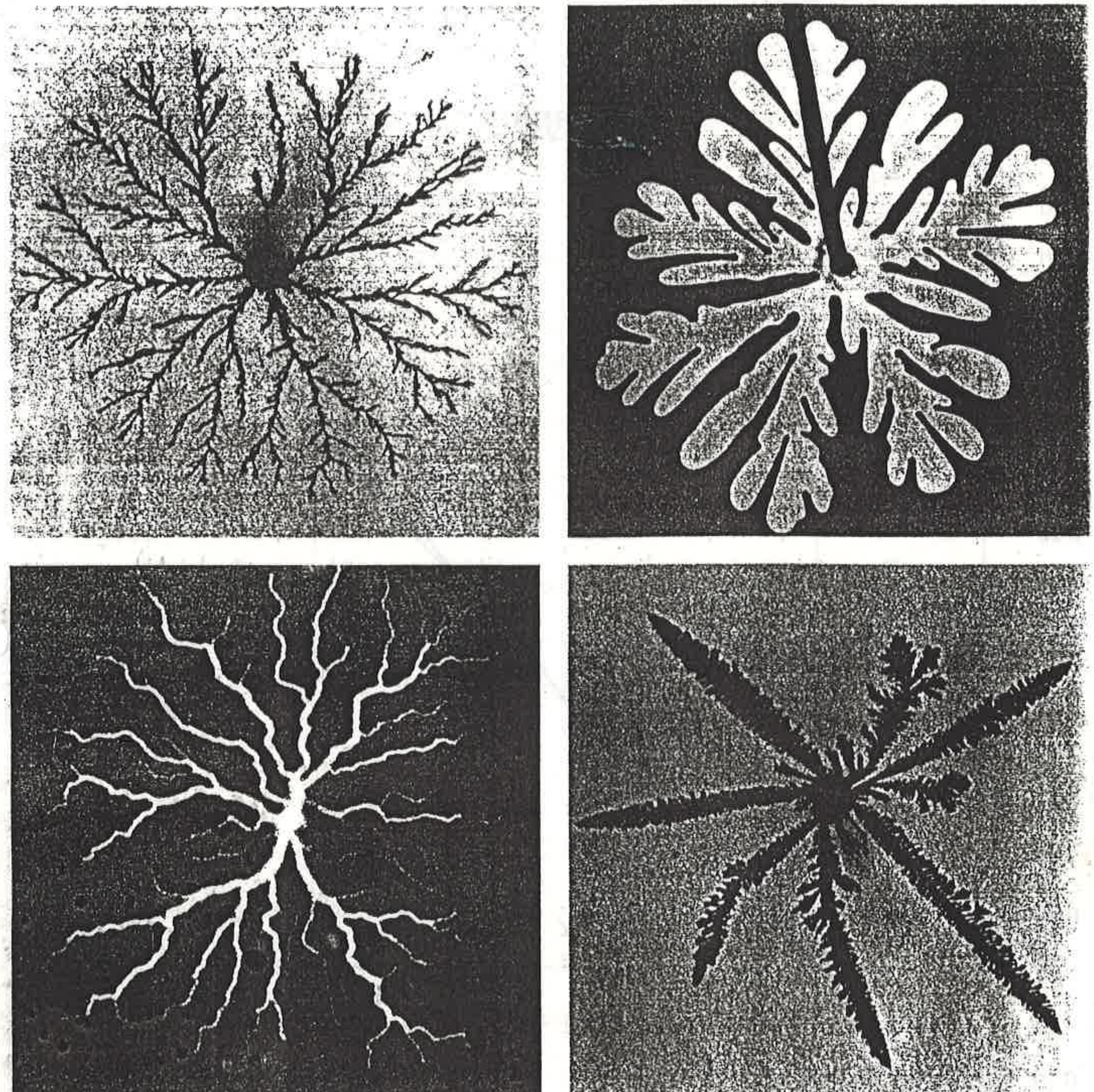
Plate 16
This beautiful picture *(courtesy of Y. Furukawa, Hokkaido University)* exhibits a number of features characteristic of most of the virtually infinite variety of snowflakes. It has a well pronounced sixfold symmetry, however, this symmetry is not perfect. The completely filled central part represents a different kind of morphology than the outer dendritic branches. Due to a special effort when taking this picture it is also exceptionally suitable for demonstrating the three-dimensional nature of snowflakes. The snowflakes are crossing different layers of air while falling down in the atmosphere, thus, they undergo randomly changing different physical conditions. Correspondingly, their width and local shape (closely related to the actual growth regime) change in a complicated manner.

[T. Vicsek, "Fractal Growth Phenomena"]

FRACTAL GROWTH



FRACTALS IN NATURE appear to grow by means of diffusion-limited aggregation. Shown here are a zinc deposit formed in an electrolytic cell (*top left*), a "viscous fingering" pattern of an air bubble in glycerine (*top right*) and an electrical-discharge pattern called a Lichtenberg figure (*bottom left*). The thick line that ends at the center of the bubble is an air tube. The zinc cluster at the bottom right shows what happens when the voltage in the electrolytic cell is increased: the growth pattern shifts from a fractal pattern to a dendritic, or snowflakelike, pattern. The zinc deposits were produced by Grier and the viscous-fingering pattern was produced by Eshel Ben-Jacob of the University of Michigan. The Lichtenberg figure is from L. Niemeyer and H. J. Wiesmann of Brown, Boveri & Company, Limited, in Switzerland, and Luciano Pietronero of the State University at Groningen.

L. M. Sander, Sci. Amer. 256, 94 Jan. 1987

8.2.2 Dielectric Breakdown

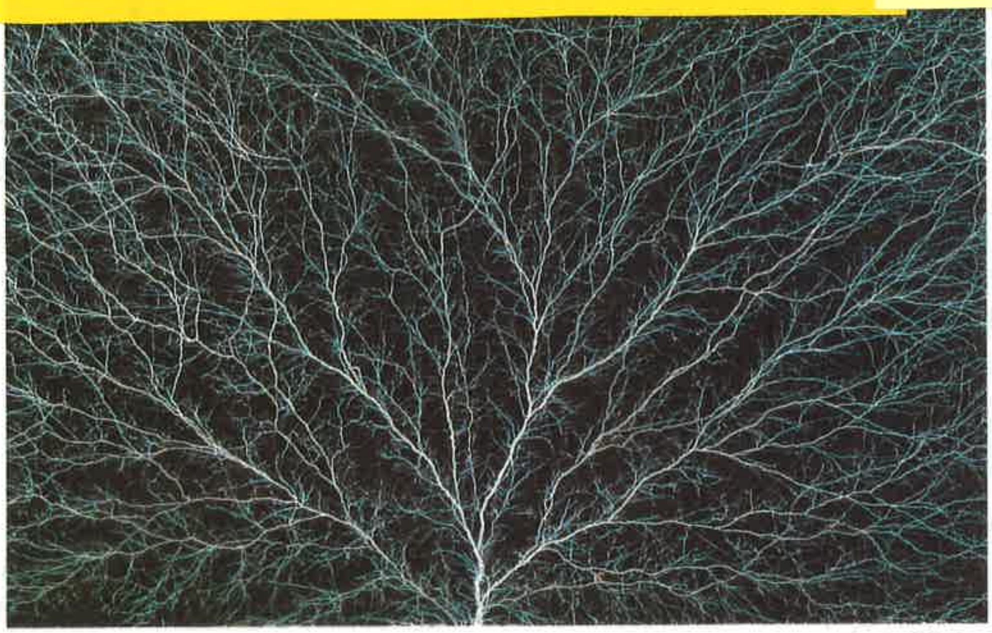


Fig. 8.1. Discharge pattern in a block of polymethyl-methacrylate (PMMA). The material is charged with 2 MeV electron beam and subsequently discharged through a point contact. The sample was prepared by A. Miller

(8.1)

[A. Bunde & S. H. Havlin, "Fractals & Disordered Systems"]

Photograph of a soft coral (Solomon Islands, by Carl Roessler)
[A. Bunde & S.H Havlin, "Fractals & Disordered Systems"]

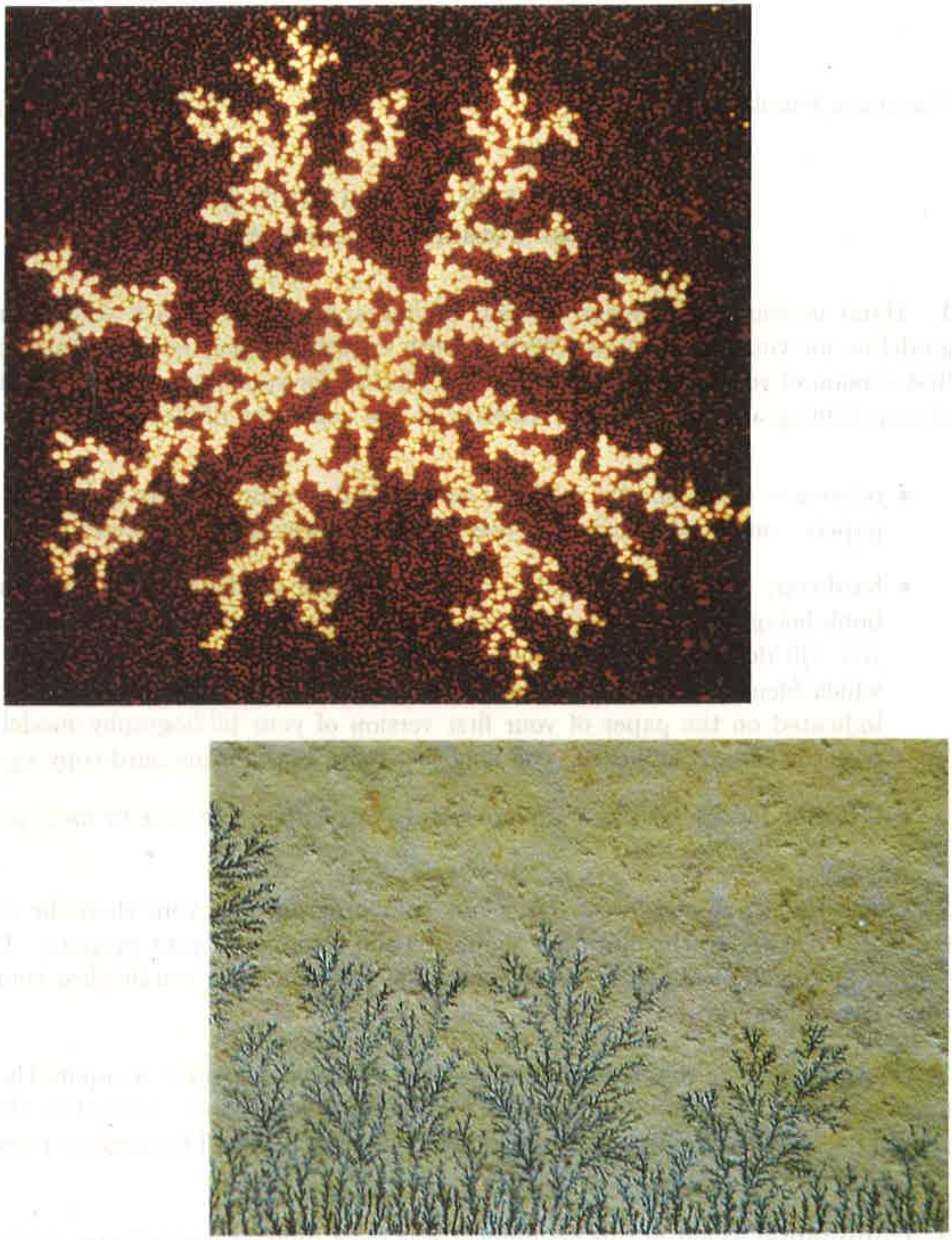
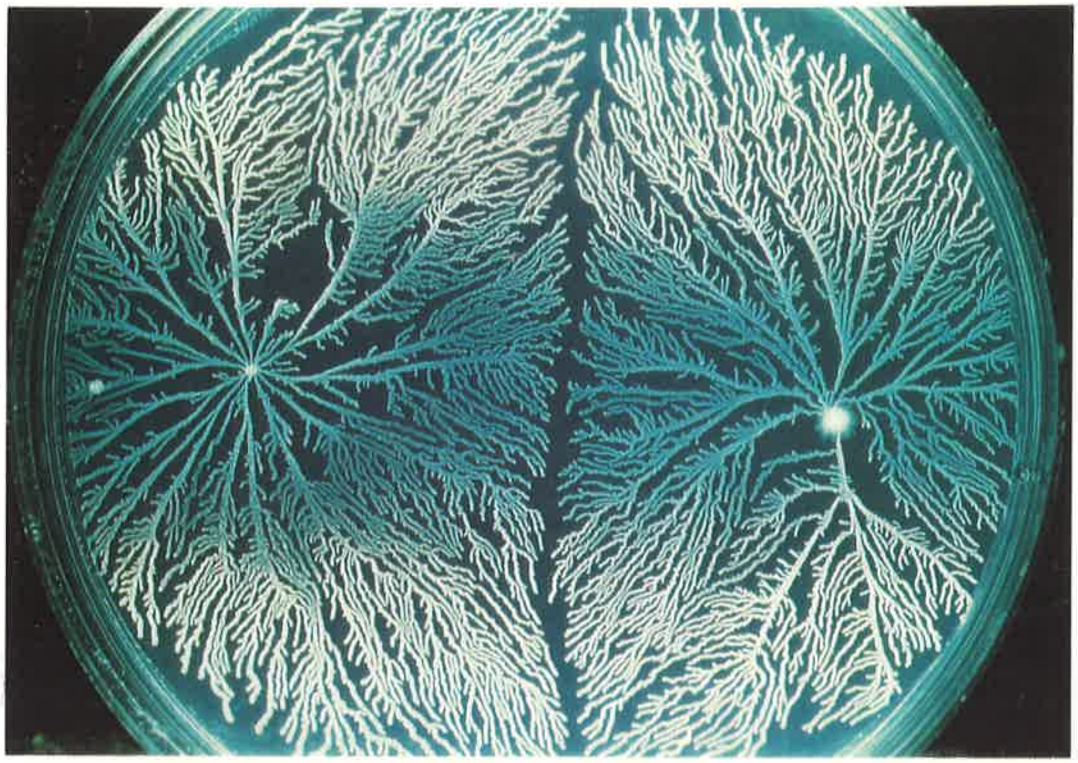


Plate 9
Examples for fractal growth patterns analogous to diffusion-limited aggregates. The upper picture was obtained in a simple experiment in which air (white) was injected through a central whole into a thin layer filled by a viscous liquid (red) and randomly distributed small beads kept between two transparent plates *(F. Family and T. Vicsek, Comp. Phys. No. 1 (1990) 44)*. Bottom: The mineral dendrites shown in this picture *(courtesy of J. M. Garcia-Ruiz, University of Granada)* are chemical deposits (oxides) that formed when at some point in the geological past a thin layer between two limestone plates was penetrated by a supersaturated solution of manganese ions entering through a crack perpendicular to the layer.

[T. Vicsek, "Fractal Growth Phenomena]

[redacted]



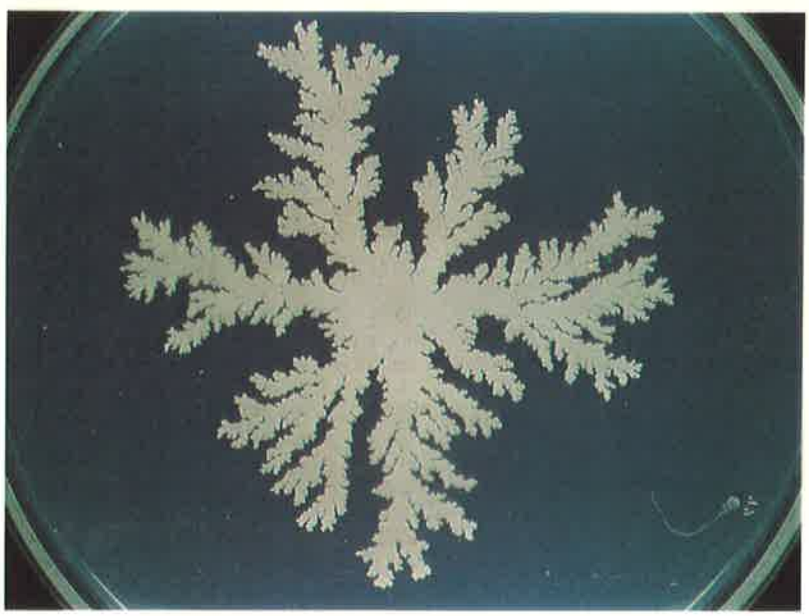
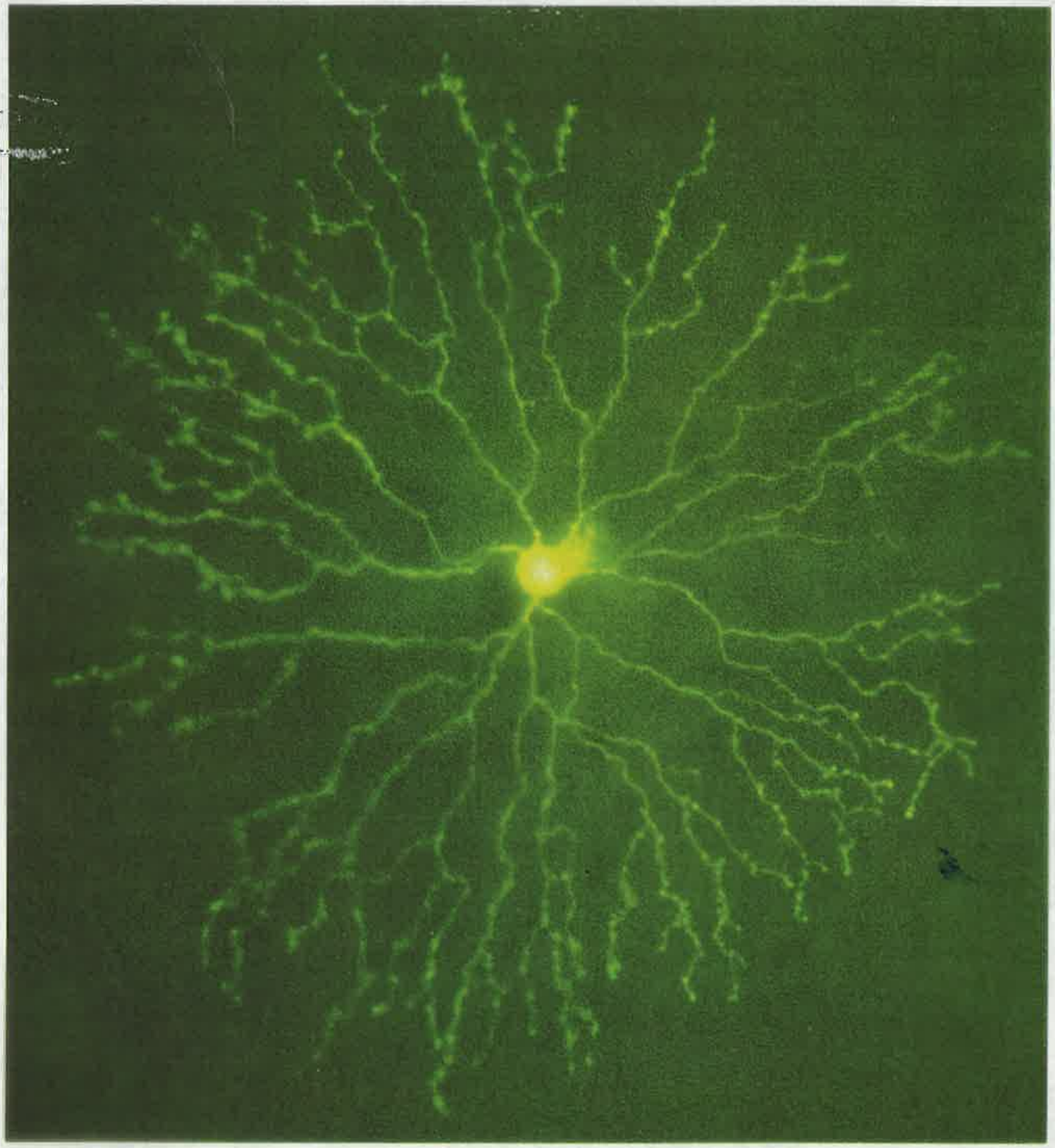


Plate 12
Bacteria colonies growing on the surface of agar plates (layers of gel containing nutrient usually kept in Petri dishes) may develop very complex morphologies depending on the conditions during the experiments. The upper picture was obtained by inoculating the agar's surface at two points with a drop from a culture of *Bacillus Subtilis* (a common kind of bacteria which can be found in our food) and letting the two-dimensional bush-like colonies grow towards each other. If the agar has less nutrient and the humidity in the incubator is kept at a lower level the shape of the bacteria colony (bottom) becomes analogous to a diffusion-limited aggregate *(courtesy of M. Matsushita, Chuo University).*

[T. Vicsek, "Fractal Growth Phenomena"]

Neuron from the retina (R. H. Masland)



[A. Bunde & S.H. Havlin, "Fractals & Disordered Systems"]

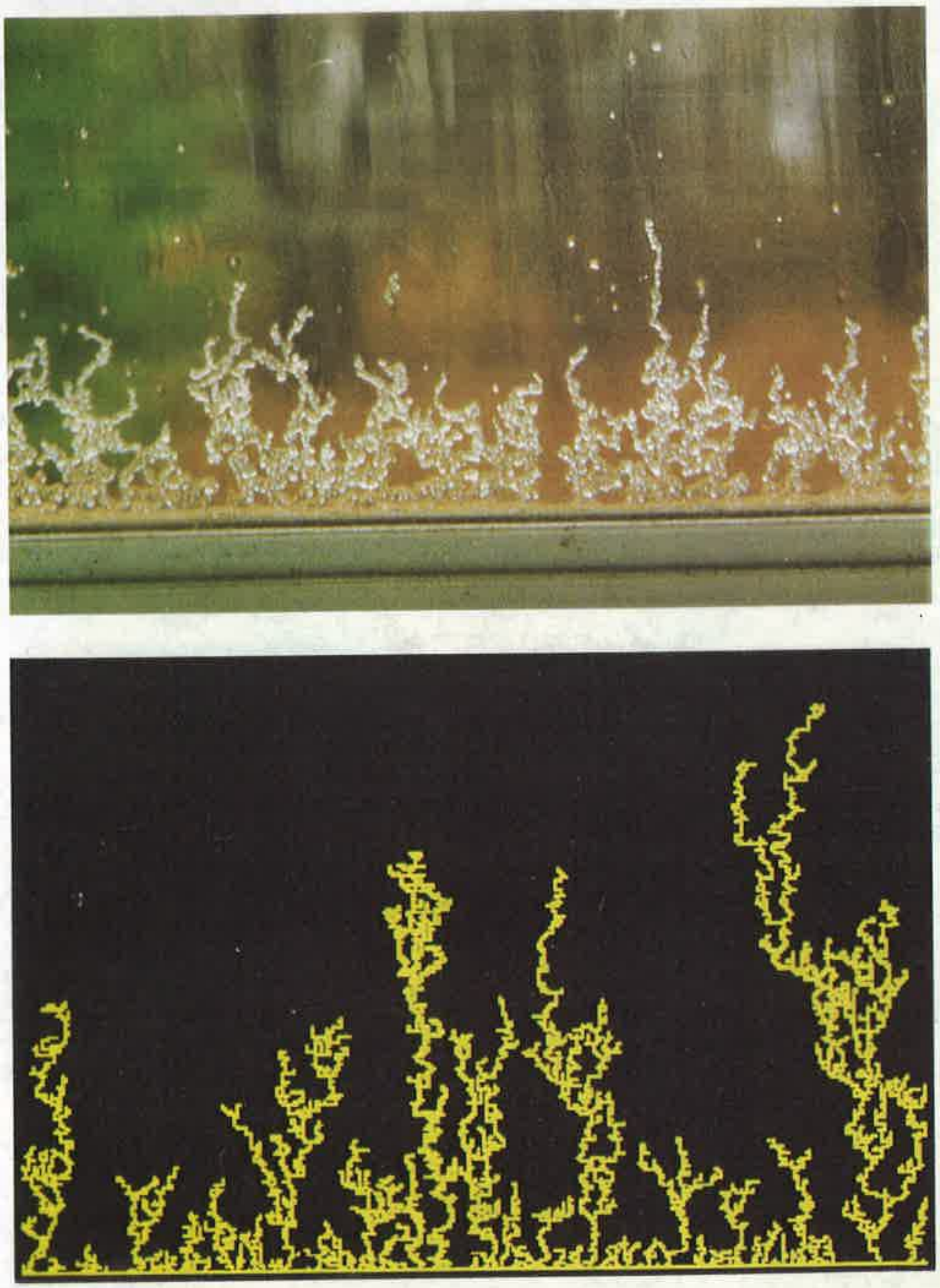
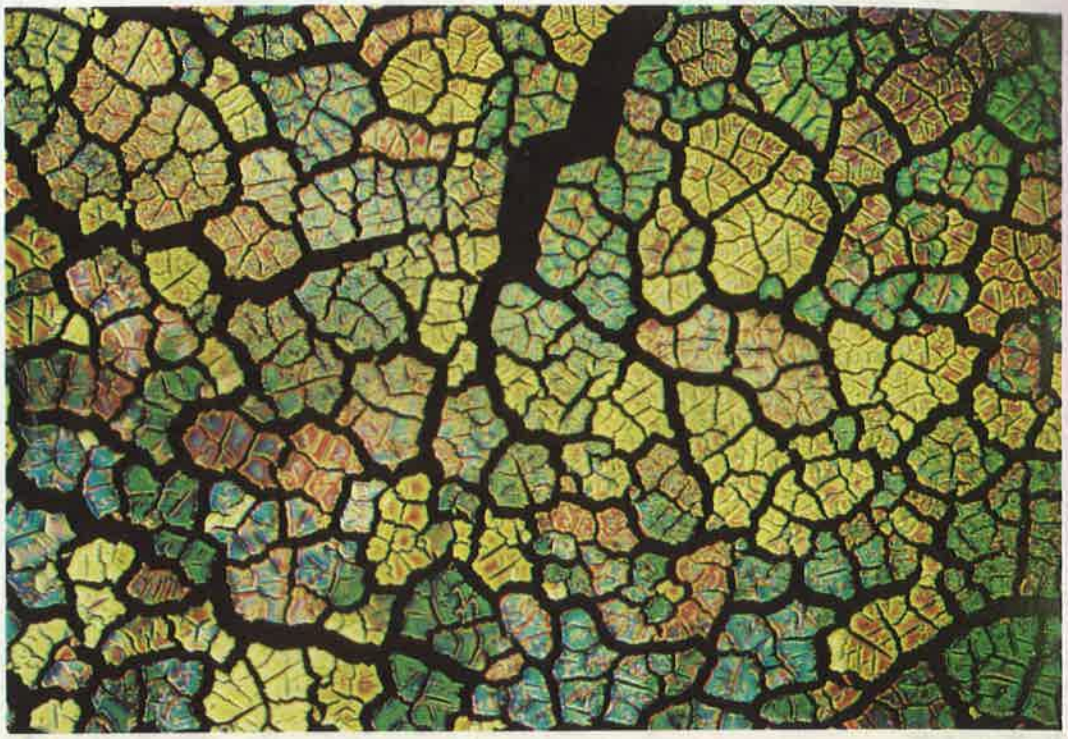


Plate 2
Two related variants of ballistic deposition. i) Example for ballistic deposition on a macroscopic scale (top). This picture shows snow particles sliding down a glass window and forming an aggregate as they stick together on contact *(courtesy of R. Lenormand, Institut Francais du Petrole)*. ii) The bottom picture was generated by a correlated ballistic deposition model in which the particles had a larger probability to be aggregated at positions close to that of the previously added particle *(F. Family and T. Vicsek, Comp. Phys. No. 1 (1990) 44)*. An analogous behaviour is expected to govern the motion of the snow particles which, in the situation shown in the upper picture, are likely to prefer the freshly wetted paths along the window's surface.

[T. Vicsek, "Fractal Growth Phenomena"]



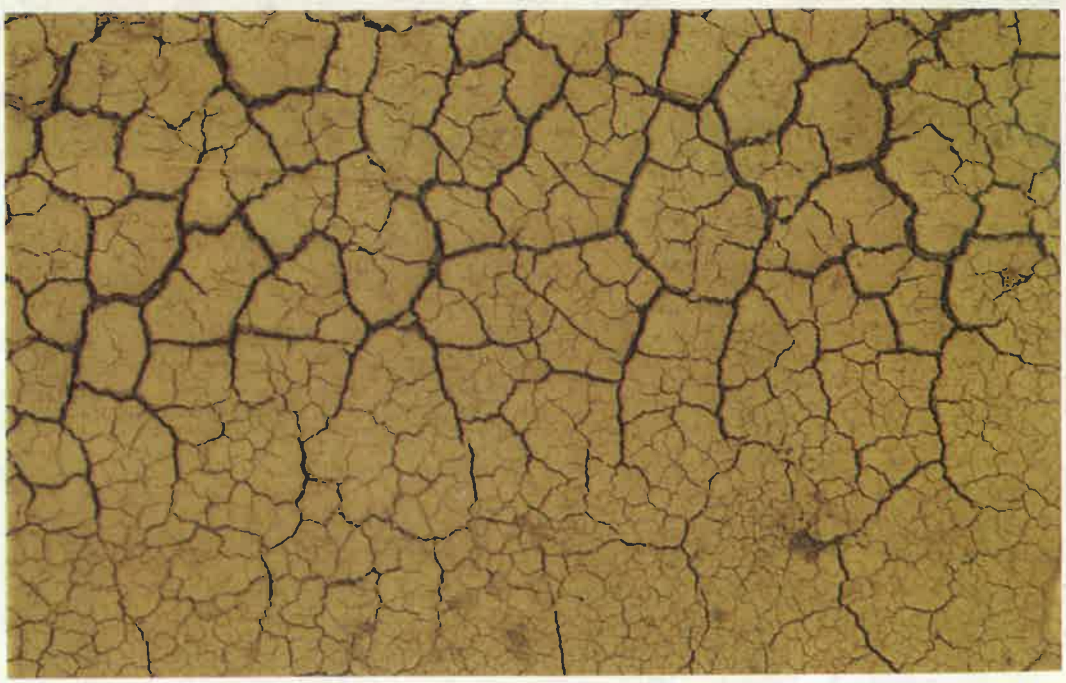


Plate 15
The cracks in the upper picture were formed in a system composed of approximately one million small plastic spheres each of diameter 0.0034 mm. The spheres were originally arranged in a single layer on a wet surface and the cracks were created as a result of shrinking during the process of drying *(Skjeltorp and Meakin, 1988)*. The bottom part of this plate shows a strikingly similar crack network one can observe in a dried out field with clay soil.

[T. Vicsek, "Fractal Growth Phenomena"]

Minaret Cauliflower, of F. Grey
[A. Bunde & S. H. Havlin, "Fractals & Disordered Systems"]