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SPECIALIZATION IN SCIENCE[1]

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IN the organic world it is the generalized type which gives rise to higher forms while extreme specialization means an end of progress. To illustrate from the field of botany: the mosses have been called an evolutionary failure for, although they have adopted a thousand forms, these all are too highly specialized to allow of really important advance. In the whole moss class there is a clinging to certain particular features—no freedom to produce or even to suggest anything non-moss like. Mosses have rung changes upon non-essentials but have always kept their own special pattern. The liverworts did not thus specialize but retained their plasticity, varying in many directions and at last giving rise to the remarkable Anthoceros (horned liverwort), which is almost a lycopod. And although the paleontologists may not find the "missing link" which connects liverworts and lycopod there can be no doubt that the generalized liverworts, not the specialized mosses, gave origin to the next plant division.

Among animals, also, specialization stops progress. Neither the intelligent and betrunked elephant tribe, nor the swift-footed, one-toed horse, nor the cunning members of the wolf and dog family with their great body specialization and highly developed sense organs produced the "lords of creation." Rather was it some simple creature with primitive hands and feet and jaws which began that great advance leading by one path to the grinning chimpanzee and ferocious gorilla or, by another turn, past a long series of half-human beasts to present-day man. Here, as always, the specialized types early reached a limit beyond which they could not go while generalized forms retained the

[1] Condensed from the address of the retiring president of the Southwestern Division of the American Association for the Advancement of Science, eleventh annual meeting, Tucson, Arizona, April 23, 1930.