Science, as distinguished from technology, is a common intellectual endeavor. The emphasis must be on "common." We stand on the shoulders of our predecessors, we support one another, and our successors stand in turn on our shoulders. Personal insight alone is not enough in this endeavor. We have to communicate our findings and our thoughts in language and symbolism that are as unambiguous as we can devise. The goal of scientific investigation is not simply to gain personal insight, but to gain it in such terms that we can, ideally, transmit it undiminished to another mind. Perhaps this mode of communication, which seeks to inform and to cement mutual insights in specific guise, can be contrasted with poetry. A poem that stimulates can be great even if its intended meaning is in doubt. Books can be written debating its meaning, and its value is only enhanced. In the case of a great scientific theory, matters are qualitatively different. Books can be written about its uncertain implications, or about its failings in fact or logic, but uncertainty as to its intended meaning must reflect an inherent flaw. If it is ambiguous, it cannot form the basis for common knowledge.

If raw sensuality is to be injected formally into the scientific endeavor, the challenge, then, is to devise means not only to gauge its import initially, but also to communicate its import in terms precise enough to provide a common ground for agreement. The obvious hazard is that an incomplete attempt will only provide grist for controversy among individuals whose senses differ for biological or cultural reasons. The extreme difficulty of avoiding this posture must be recognized. Public decisions to ignore, modify, amplify, or discount specific scientific insights or judgments for humanistic or political reasons, both moral and expedient, are commonplace. Sensuality of one kind or another plays a large role, and inevitably so, in these actions. Until the force of this sensuality can be expressed in a fashion more concrete than the sort of vague imagery that is customary, it would only cloud issues further to suppose that the sensuality is an integral part of the related scientific edifice under either construction or attack.

Make no mistake. I do not reject sensuality. All science is based on sensory observation or detection of some kind. I merely contend that to welcome sensuality in the abstract is to beg the question. This question is whether or how sensuality, as Blackburn uses the term, can be made systematic and communicable enough to become a part of common endeavor, rather than personal quest, for which it is assuredly the indispensable factor.

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Blackburn has helped me express thoughts that I had been unable to formulate for years.

Science teaching in the universities and in the high schools has become increasingly abstract during the past 20 years. Far from becoming more modern, we are dangerously approaching the scholastic mentality of the Middle Ages.

The general biology courses that are taught at the beginning of a scientific or liberal arts curriculum give information on abstract concepts which the students cannot comprehend because of lack of practical experience with specimens. Freshmen who take these courses must memorize and learn to manipulate abstract concepts and even come to logical conclusions without ever comprehending the contents of the exercises. Indeed, very few teachers truly understand the contents of these courses. The end results of the lifelong labors of great scientists are presented in ready-made form.

Educators have forgotten that those scientists who have made the modern discoveries could not have accomplished their feats without a thorough familiarity with nature, which begins in childhood, in backyards, woods, and fields. Intelligent, meaningful science gradually develops with the observable world around us. This is the world of visible, audible, smellable, touchable, dissectable organisms, rocks, and minerals, the visible stars and clouds, and the feelable atmosphere.

Students ought to be guided from the "sensuously" perceivable to the theoretical explanation of the observable. This is the path along which all science has evolved and the only "relevant" road for teachers of science. It is impossible to awaken enthusiasm for science when the beginning is also the end result.

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HEWLETT PACKARD
ANALYTICAL INSTRUMENTS
Analogy may be fruitful. Unsupported by logical argument it can be misleading, as Blackburn has indicated with his non sequiturs. To argue for a sensuous science from Bohr's principle of complementarity does justice neither to the idea nor to the man.

The particle and wave theories are two ways of looking at the same thing, but both were formulated and extended by rigorous mathematical analysis. Both are clearly in the mode described as "quantitative science," and their example provides no analogical support for Blackburn's leap into an alternative, sensuous domain. Furthermore, by equating intuition simply with sensuous experience, he ignores the whole history of scientific inquiry in the intellectual domain. Creative investigation has always been nurtured by intuitive insights, guesses, and hunches, but these have been tested later as rigorously as possible. After all, intuition can be wrong.

Finally, Blackburn is quite wrong when he excludes the holistic naturalist from the act of simplifying reality for the sake of intellectual comprehension. No one can define, let alone understand, the numbing complexity of reality. We are all of us quantifiers and feelers (and what emotion-laden words these are), homomorphic or many-to-one mappers and modelers. We select certain things and filter out the rest. The question is whether we should be more aware of the filters.

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If the idea of complementarity is generalized from its precise, operational meaning in quantum physics, so that it becomes a broad philosophical tenet that takes into account the behavior of the human observer, it is wholly indistinguishable from the philosophical concept of pluralism as advocated by William James in *A Pluralistic Universe*, first published in 1909.

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I had no intention of advocating unseemly leaps into alternative domains; that would be as big a mistake as to deny the human and scientific importance of sensuous experience. It is to the second error that I addressed my-
self, feeling that the first was relatively unlikely to occur within the house of science. Rather than reasoning by analogy from physical to sensuous-intellectual complementarity, I tried to generalize the idea of complementarity, and then to show that both types may be examples of a fundamental epistemological phenomenon—an enterprise, by the way, that Bohr himself pursued for the last 30 years of his life.

I agree entirely with Dickinson. Our codification, so to speak, of sensuous knowledge is centuries behind our analytical systems. In fact, as embodied in art and poetry, it has indeed become embedded in "personal quests," where it has shown, in capable hands, a very powerful precision. However, since at least the era of Goethe, Coleridge, and Faraday, the sensuous and the analytical have followed different concerns—to the detriment of both.

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Artichokes

I refer to the technical comment by Eisner and Halpern (25 June, p. 1362) on the article by Whittaker and Feeny (26 Feb., p. 757), on chemical interactions between organisms.

A less dramatic distortion of taste occurs after one eats artichokes, the flower heads of Cynara scolymus: things taste sweet.

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Reciprocity

Sev S. Fluss (Letters, 11 June, p. 1083) complains that Russian scientific authors in citing non-Russian sources fail to give the original (that is, Latin) spelling of names along with the transliteration. Before the AAAS adopts his suggestion that it urge this worthy practice on the Russians, it might urge the editors of Science (and other American journals) to adopt the practice of including the Cyrillic spelling of Russian authors' names in citing them.

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mitr agents. With a sensitive radioassay, histamine was shown in highest concentration in the hypothalamus, was localized to synaptosomes with slightly different density than norepinephrine- or γ-aminobutyric acid-containing nerve terminals, was decreased by inhibition of histidine decarboxylase (turnover half-life only 5 minutes), and was affected by stress. It is clear that such transmitters as acetylcholine and norepinephrine account for only a very small percentage of all the synapses in the central nervous system; therefore, the evaluation of additional potential transmitter substances is an active field. No defined genetic diseases have been associated yet with an abnormality in neurotransmitter metabolism.

R. Rosenberg (University of California, San Diego) presented data on neuronal differentiation in vitro. He used both dissociated normal brain cells from neonatal BALB/c mice and transformed mouse neuroblastoma cells and found that morphologically differentiated neurons appear in culture with characteristic spike potentials upon stimulation and that several neurotransmitter-related enzymes can be detected, though synaptosomes and synaptic transmission have not yet been demonstrated. The effects of serum, of protein synthesis inhibitors, and of the microtubule-protein-binding substance colchicine can be evaluated in culture. Cells seem to become highly differentiated only as they slow their rate of cell division. Acetylcholinesterase activity increases rapidly as neuronal processes appear, while catechol-O-methyltransferase and other enzymes do not share the same pattern of regulation. Since there is evidence for both norepinephrine and acetylcholine in these clonal cultures, it will be very interesting to learn whether a single neuron can produce only one or the other of these neurotransmitters when it becomes highly differentiated.

Specialized processes of differentiation in brain may be engrafted upon those common to other tissues, and environmental modification leads to complex behavioral phenotypes, particularly in man. Nevertheless, there was optimism that experimental approaches of the type discussed can unravel some of the mystery of gene action in the nervous system.

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