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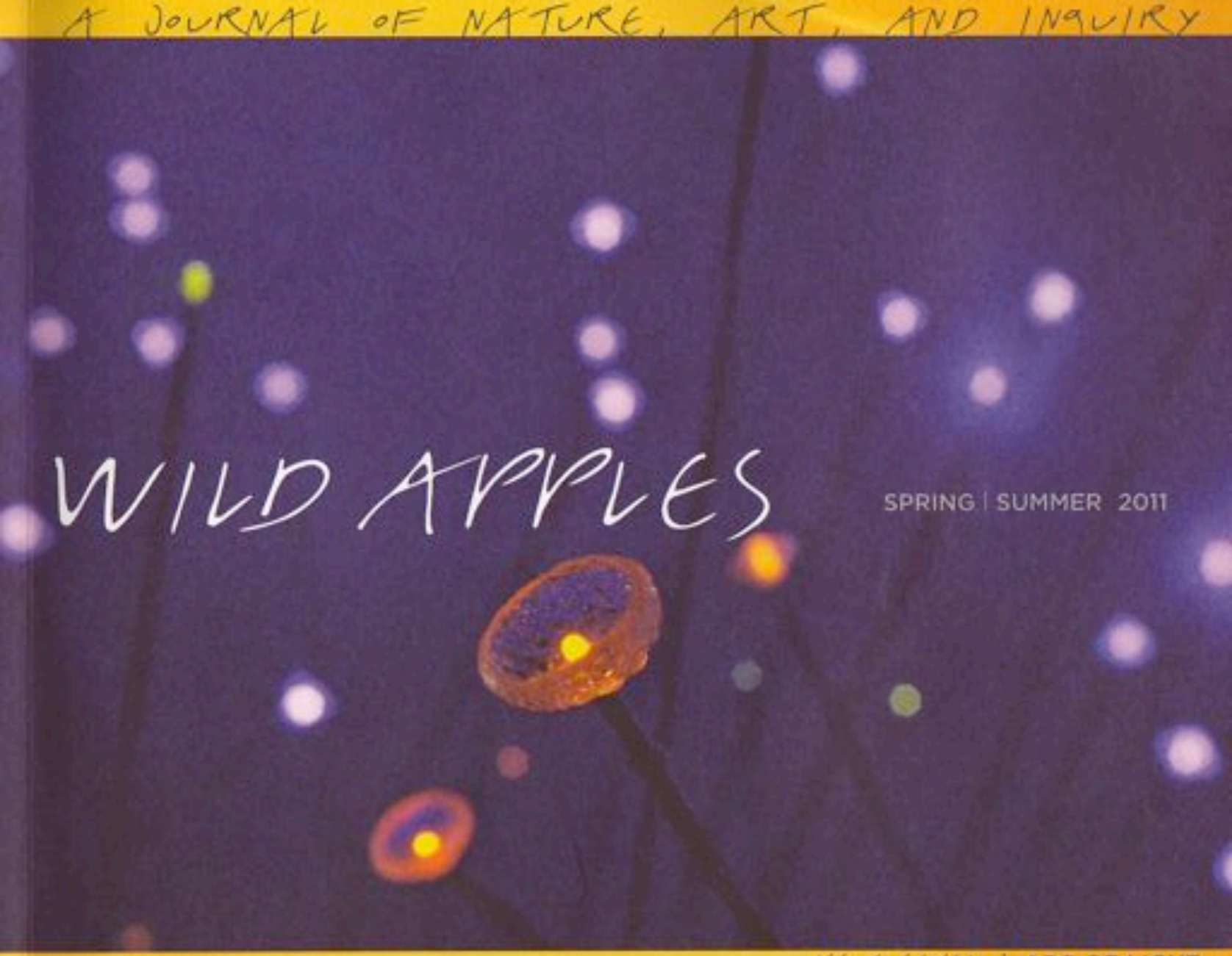

WILD APPLES

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The Thin Blue Line

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As a child, I loved to paint the sky. I would dip a brush into thick blue poster paint (its faintly sour smell comes back to me now), then make a glistening blue stripe all along the very top of the paper. I even enjoyed watching that paint dry, its bright reflectivity quickly dimming to reveal a flat, calm hue: the sky. Satisfied, I would then go on to add whatever figures I had in mind, but somehow that first stroke was particularly significant, as if it were the basis for the whole picture, my gateway to experiencing and making it. I noticed that my school's colors were blue and white, evoking the ambience of its city, San Francisco, associated in my mind with sky and fog.

One day, though, an art teacher looked at my painting and told me, quite gently, that my sky wasn't right. It shouldn't just be a line at the top, she said, but should fill in the whole area below it. Perhaps she even took me to the window and showed me how it looked. I was outraged — even after all these years I still remember the intensity of that emotion, out of character for the rather docile, obedient child I remember being. Looking back, I cannot quite fathom my full feelings. Partly I felt betrayed. How was I to know that what I had been doing was wrong (even that word seems wrong)? I had always painted the sky with a single stripe, as long as I could remember. To this day, I wonder why I did so, and not only I but many other children whom I have noticed over the years painting that high blue line.

Perhaps I, like them, had simply imitated some other child, then forgotten that primal act of mimicry. But I could not remember any such moment of imitation, and cannot even now. I was bewildered. That was my sky, however or wherever I had learned it. I could not imagine how I could do otherwise. To change the sky seemed somehow terribly wrong, as if it shook my world, made it impossible for me to go on. Nor was I stubborn or independent enough just to keep painting as I always had. I just stopped painting, which hurt because I loved it. And I held that story in my memory as a kind of talisman, though I did not know for what. But as time passed, I thought about it less and less, one of many enigmatic objects in my personal storehouse of memory.

About fifty years later, I found myself writing a book about the history of how people understood the sky's color and luminosity. At the time, I did not connect this with my own story. In the intervening years, I had studied physics and became aware of the standard explanation of the sky's color as the scattering of sunlight by air molecules. Out of indolent curiosity, I wondered how that understanding had been reached, what people had thought before

about the sky. As I read and began to draft this history, gradually what I had taken as clear and certain turned foggy and unsure.

The physicists' explanation became enshrouded with a penumbra of questions and doubts. The whole question had baffled Isaac Newton. His explanation that the sky's color was caused by the colored iridescence of air-borne water bubbles was beautiful and pathetic; why did he not realize that those bubbles could not last, though the sky retains its blue in the driest days?

My thinking coalesced around a strange story that struck me particularly: In the years just before the First World War, the Polish physicist Marian Smoluchowski had tried to make an artificial sky by trapping gas inside a bottle and shining light on it. Something about this image fascinated me — perhaps the whimsicality of putting the vast sky inside a bottle. I began to wonder what had happened, for Smoluchowski himself had died in the war, his experiments still incomplete. Was it perhaps possible to put the sky in a bottle? This became the title and theme of my book. I even dreamed of a bulb one could have in one's living room that would radiate the pure blue of the sky itself.

The search to put the sky in a bottle turned on the nature of light itself. In order for the sky to be blue, rather than some other color, the incoming sunlight needs to have some quality capable of distinguishing colors. The iridescent colors of bubbles that drew Newton's attention was a clue: Later evidence clarified that light has wavelength, which enables it to scatter differently from the objects in its path. As John Tyndall realized around 1870, the various waves of sunlight are like ocean swells that barely disturb a large ship but cause a small boat to rock wildly: blue light, having a shorter wavelength, would make the little boat rock even more than red light. This crucial realization then moved the painter and writer John Ruskin to surmise that the very molecules of air were the "boats" whose wild rocking was manifest as the

scattered blue light of the sky. Independently, a suggestion from James Clerk Maxwell led Lord Rayleigh to calculate the size of the scattering molecules from his observations of the way the distant Himalayas merged into the blue sky: Rayleigh's calculation connected the distance of the farthest discernible mountains with the size of the tiny objects that scatter the light coming from them.

Living in the high desert of Santa Fe, I found that I could replicate Rayleigh's train of thought by observing Mount Taylor, a hundred miles away and barely visible on the horizon. It was a thrill to realize that these familiar, almost invisible peaks enabled one to calculate, roughly, the size of atoms. From this I understood that the blue sky and its light are the most beautiful proofs that atoms exist, using evidence of the naked eye rather than sophisticated instruments.

Reading Tyndall's experiments, I realized that he (and likely Leonardo da Vinci before him) had also tried to put the sky in a bottle. Da Vinci probably used simple chemicals that produce a lovely azure liquid; Tyndall went further with gases like butyl nitrite, which he described as giving a bottled sky that "rivals, if it does not transcend, that of deepest and purest Italian sky." I was all set to try to see this for myself when I learned that the gases he was using were so toxic, explosive, and carcinogenic that I could not even obtain them, much less mess with them. I gave up on persuading chemists to try such forbidden experiments in their protected, safety-enhanced laboratories. So much for my dream of a sky in a table lamp.

My experiences brought to mind another memory, this from early adolescence. For a science fair, I became interested in variable stars, whose observed brightness rises and falls with great regularity. I loved them but could not figure out how to illustrate their periodic fluctuations in a science project. The best I could do was hook up a light bulb with a store-bought device that would

periodically dim and brighten the light so that it shone through a pinhole, as if that were the variable star. Soon I saw how pathetically inadequate my little device was to represent this great phenomenon, of which I knew so little and could show even less. Was not my writing about the sky very much like this, as if a light bulb could ever do justice to a star? Or a blue stripe portray the sky?

Imagine, then, my perplexity when I realized that the sky was not really blue. First, it contains every possible hue, which the eye and brain integrate to make the perceived sensation of "blue sky." But what is that underlying mixture of colors? Both Rayleigh's physical theory and actual observations by a spectrophotometer show that the largest component of the sky's color is violet, not blue. Of course, we are right to call the sky blue, thereby almost defining that color-word, but eyes other than ours might be able to see its predominant violet hue, as the spectrophotometer does. The resolution lies in our eyes and brains, whose sensitivity to violet is much less than to blue.

I was so keen to see that "true" violet sky that I tried to evade the eye's limitations. Though the retinal cones are relatively violet insensitive, the rods, used for night vision, are more sensitive to violet. So at dusk I waited with my eyes closed, hoping that if I opened them at the right moment, it would be dark enough for my rods to let me glimpse the violet sky at last. But no; rods, though more violet sensitive relative to the cones, are far less sensitive to any color; human night vision is predominantly a black-and-white affair. I did not see violet, but just the washed-out remains of the fading day.

I realized then that the sky is contained in the ultimate bottle, my mind, which further exposed my limitations but also in some way helped me become more reconciled to them. The sky we see is constructed by our minds by processes of which we know very little, as yet. Hearing, by comparison with seeing, is a far rawer, more direct affair, less mediated by the complex hierarchies of processing that govern vision. Because of this immediacy, Nietzsche rightly termed the ear "the organ of fear." If you mingle two differently colored lights, a single hue is perceived, but if you press several keys on a piano, they remain distinct pitches, not blended.

The eye, by contrast, may be the symbolic organ par excellence, synthesizing myriad spectral hues of the naked sky into a single perceived hue of blue that stands in their place. If true, our so-called "abstract" modes of thought, symbolic in character, may ultimately go back to vision, even where they seem to leave behind what we see. Think, then, of a single stripe of blue at the very top of the paper, more a symbol of the sky than a literal representation of it. A child's painting may record something of the symbolic force of the sky and of the mind that feels itself constructing it, something lost when that blue is spread out in an effort to mimic reality. A single blue line connects the mind, the mystery of light, and the thin, precious atmosphere that barely surrounds our planet.