nally determined that even with 3% NaCl the salt segregated into fences during the freezing-etching procedure. Ice seems to be able to cleanse itself of salt with remarkable speed.

Low temperature scanning electron microscopy of artificial snow

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Low temperature scanning electron microscopy (LTSEM) has been used to observe and characterize fresh and metamorphosed naturally formed snow crystals.[1] These crystals form in the atmosphere by a process known as vapor deposition, in which molecules of water vapor (gas) bind to form a crystal (solid). No transitional liquid phase occurs. Atmospheric temperature during crystal formation largely influences the structure of the crystals, which may develop into dendrites, plates, columns needles or irregular crystals, whereas the time of formation influences their sizes. Once formed, the descending snow crystals may encounter supercooled cloud droplets. The droplets impact and immediately freeze to the surface of the crystal, which is then referred to as being rimed. Continuation of this process, which is known as accretion, results in a mass of frozen droplets, referred to as graupel.

Snow, which may cover up to 53% of the land surface in the Northern Hemisphere and up to 44% of the land areas of the world at any one time, provides most of the water that is used for consumption, agriculture and energy production in the western U.S. However, snow also provides a recreational need. Cross-country and downhill skiing, snowboarding, -shoeing and -tubing are sports made possible by the presence of snow. To increase the length of the sport season or to supplement or substitute for natural snow, production of artificial snow has become a multi-million dollar industry. The process by which artificial snow is made radically differs from that which occurs in nature. Briefly, water, which is frequently "spiked" with an ice nucleating agent, is atomized under pressure and blown into the sub-freezing air from snow guns. Before reaching the ground, the microscopic droplets freeze to produce the artificial snow commonly used at winter sport sites. This study uses LTSEM, to characterize artificial snow and to compare its properties to those of natural snow.

Artificial snow from Vermont and Utah was collected, frozen and shipped for LTSEM imaging using procedures previously described for natural snow.[2] The artificial snow collected from the plumes of different snow guns ranged in appearance from individual spherical pellets that measure 0.1 to 0.8 mm in diameter to aggregations of these pellets (Fig. 1). Fractures reveal that each pellet consists of a single ice crystal that is surrounded by a surface layer of free water. During production, artificial snow accumulates under the snow guns in mounds called "whales", which may reach depths of 1–3 meters. Samples collected at the surface of the mound contain pellets exhibiting some sintering or bonding. After "curing" for one hour in the whale, most of the pellets are sintered; whereas, samples taken from depths 50 cm below the surface are highly sintered and closely resemble natural freeze/melt metamorphosed snow grains that occur in alpine regions under spring conditions. Plowing, tilling and grooming artificial snow produces surface structures similar to those of natural wet snows.

FIG. 1 Artificial snow collected in the plume of a snow gun. Artificial snow appears as small ice pellets. Natural snow, falling at the time of sampling, resulted in the fortuitous presence of the stellar dendrite along with the artificial snow. Sample collected at Sugarbush, Vermont.

In conclusion, artificial snow appears as microscopic pellets. The types of snow guns and use of ice nucleating agents, influence the sizes of the pellets and the efficiency of production. Artificial snow, which results from the freezing of a liquid, most closely resembles the natural process of accretion that results in riming and graupel. Because sufficient time for vapor deposition seldom occurs, artificial snow does not exhibit the crystalline shapes found in natural snow.

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Characterization of GFP arrays grown on nanostructured interfacial templates using Cryo-FESEM

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Previous research in the Thompson laboratory has shown that metal chelating lipids like 1,2-dihexadecylglycerol-3-N^{ε}-lysine nitrilotriacetic acid (DHGN) can be effective agents for catalyzing the assembly of histidine-tagged (His-tag) proteins at the air-water interface in the presence of Ni^{2+}.[1,2] We are currently exploring the effects of interfacial structure and dynamics on the assembly of two-dimensional (2-D) protein crystals with an eye toward forging an understanding of the basic principles involved in the 2D crystallization of soluble proteins. We are pursuing this goal using His_6-tag GFP and a family of amphiphilic nitrilotriacetic acid (NTA) chelating lipids possessing C_3- or C_4-fold symmetry that are spread as monolayers at gas-liquid or liquid-solid interfaces. These materials are based on two different design types: (1) covalently-coupled NTA chelating groups that require lateral diffusion of the lipid-protein units for crystallization and (2) noncovalent NTA-based amphiphiles that can sustain the development of long-range order by either site-hopping or lateral diffusion mechanisms. The non-covalent amphiphiles are a novel, two-component system consisting of a hydrophobized cyclodextrin host molecule and a NTA-modified guest ligand.[3] Confocal microscopy, C-FESEM, and atomic force microscopy (AFM) results indicate that the molecular structure and dynamics of the interface does affect the order of the adsorbed GFP molecules over nanometer-micron length scales and can template the formation of GFP crystals, presumably via epitaxial growth.

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Cryo-EM methodologies for structural investigation of elastin-mimetic biomaterials

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The proteinaceous material elastin is the primary structural component underlying the elastomeric mechanical response of extracellular matrix in vertebrates, and its structural integrity is critical for the appropriate physiological function of compliant tissues including blood vessels, lung, and skin. Elastomeric behavior remains a rarely observed phenomenon among fibrous proteins, such that elucidation of the structural factors that are determinative for this mechanical response may provide information on the functional relationships between bioelastomers as well as facilitate the design of novel elastomeric materials for tissue-engineering applications. Elastin consists of a cross-linked matrix of a precursor protein, tropoelastin, which is characterized by a modular sequence of alternating, structurally distinct elastomeric and cross-linkable domains. The elastomeric domains comprise structurally similar oligopeptide motifs that are tandemly repeated in the native protein sequence. The local secondary structure and macromolecular thermodynamic and viscoelastic properties of the elastomeric domains can be emulated in synthetic polypeptides that are composed of a concatenated sequence of the native oligopeptide motifs; the most common of which is the pentapeptide (Val-Pro-Gly-Val-Gly). Genetic engineering techniques enable the preparation of elastin-mimetic polypeptides composed of complex sequences that may display different morphological, mechanical, chemical, or biological properties.