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FROM THE SCIENCE OF SNOW TO THE THEOLOGY OF SNOW

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Abstract: The invention of the microscope in the seventeenth century was one incentive leading to great interest in snow, its origin, its place in nature, and, in particular, in the form of snowflakes. The article presents the scholarly research of snow in the seventeenth and the eighteenth centuries and the interest of theologians in snow as one natural element pointing to the existence and the attributes of God, and as a means of deriving from it some spiritual teachings. Chiono-theology, the theology of snow, was a part of physico-theology very popular in these times and it was motivated by the conviction that the physical investigation of nature should lead people to the recognition of the Creator and consequently to the alignment of the human life with God's moral code.

1. Kepler on snow

In 1611, Johannes Kepler published a slim booklet, intended as a somewhat playful Christmas gift for a court counselor in Prague, in

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which he investigated snow[1]. “Here it is, a question about snow[flakes]: ...before they are entwined into larger tufts, they always fall hexagonal and with six rods, villous like small feathers. ...if it happens by accident, why do not pentagons fall equally or heptagons, but always hexagons when they are not yet clustered together and bunched up in masses by various impulses, but they are still scattered and separated?” (5). So, the prevailing hexagonal shape in snowflakes was something worthy of investigation, and investigate Kepler did it by proposing possible solutions one after another and rejecting them as not quite satisfactory. He looked at how space is packed in a beehive and in pomegranates (7). In the case of pomegranates, he spoke about the soul of plants (*anima plantae*) as the cause of the orderly arrangement of seeds in it (8). How can globules in space be packed as tightly as possible (9)? Bees work by instinct when building honeycombs, for “the archetype was imprinted [on them] by the Creator” (10), God prescribed these “laws of architecture” followed by bees. However, it was superfluous to think about the soul in pomegranates if material necessity that required using rhomboids was taken into account (11); and yet, flowers usually have five petals, so the soul of these plants does appear to play a causal role. The golden section and the Fibonacci numbers have been mentioned. Then cold was considered as a cause of condensing vapor into starlets (12). In an attempted analogy, the interaction of cold and hot temperatures was considered in the way steam forms patterns on windows in winter (13). However, “we did not benefit anything” from the discussion of the arrangement of vapor particles in three dimensions in conjunction with the working of heat and cold (17). “Therefore, having examined all that was presented, I feel that the cause of the shape in the snow is no other than that of the ordered figures in plants and of numerical constants. And since in these things nothing happens without a supreme reason, not indeed that which is found by discursive reasoning, but that which was originally in the design of the Creator, and from that beginning until now is preserved by/in the wonderful faculties of animal nature, I do not believe that even in snow this orderly figure exists by chance. There is, therefore, a formative faculty (*facultas formatrix*) in the body of the Earth, the vehicle of which is vapor just as the human soul [is the

[1] J. Kepler, *Strena seu De nive sexagula*, Frankofurti ad Moenum: apud Godefridum Tampach 1611.

vehicle] of the spirit: so much so that no vapor exists anywhere, unless it is bound by the formative reason, which others call the maker's heat, just as, as it is said, it/vapor is preserved by this heat and continues to be [vapor]". Also, although the starry shape of snowflakes does not make them more durable, they become by it more beautiful since "the formative reason does not act only on account of an end/purpose, but on account of adornment/beauty", both in animate and inanimate nature (18). The working of the formative faculty that determines shape likely depends on the kinds of material in a mixture, so, the form of a snowflake may depend on the salt in snow, the composition of which should be determined by a chemist (24).

Kepler's was a combination of rigorous naturalist and mathematical investigation and theological thinking. Future publications on snow would often separate the two: they will be pursuits in the naturalist explanation of snow and its properties with no or very little theological reflection, or they will be religious works which try to make theological and spiritual points using snow and its attributes with very little naturalist reflection. Physico-theology tried to merge the two approaches together to make strong theological points using the results established on scientific observations and experiments: physico-theology used the harmonious and orderly organization of nature and its particular elements to arrive at the existence of God as the wise, powerful, and eternal Creator, and the usefulness of elements of nature to speak about God's providence and goodness.

2. The science of snow

The interest in snow in Europe was present from the very beginning of intellectual life[2].

2.1. The Antiquity and the Middle Ages

Although precious little is known about the pre-Socratics, some of their thoughts about snow have been preserved. Anaximenes reportedly made a meteorological remark that snow came from water/rain coming from a cloud that then becomes hard/frozen (Diels-Kranz 13 A 7.7).

[2] For some brief history of snow research, see G[ustav] Hellmann, *Schneekrystalle*, Berlin: Rudolf Mückenberger 1893, p. 11–22; B.J. Ford, *The hidden secrets of snowflakes*, „The Microscope", 62(2014), p. 171–181; M. Sturm, *Field guide to snow*, Fairbanks 2020, p. 6.

Anaxagoras said that snow was from frozen water which was black, thus, snow was also black (59 A 97), a statement which would be frequently quoted in later ages[3]. Also, in his view, snow from Ethiopia was causing the swelling of the Nile (A 42.5); similarly, Democritus (68 A 99). Menestor said that ivy was such a warm plant that even snow could not stay on it (31 [A] 5). A bit later, some more information about snow was provided by Aristotle. In his view, moisture from the earth evaporates because of the heat of the sun; the vapors cool down in the air and condense forming clouds (*Meteorologia* 1.8); these clouds freeze producing snow (1.10).

A medieval commentator of Aristotle, Albertus Magnus (ca. 1200–1280), stated briefly that because of the intensely cold weather, "frequently in February and March a little snow falls from high, which is like the shape of a star (*figura stellae*) and falls shaped up, because then the heat of the sun expels into vapor the cold of the air left from the winter and, therefore, it becomes violent and turns the vapor before it thickens into clouds and, therefore, it falls in the shape of vapor that we have predicted" (*Liber meteororum* (1250) 2.1.10).

2.2. René Descartes

In the seventeenth and eighteenth centuries, snow became a somewhat popular topic of research, particularly after the discovery of the microscope at the beginning of the seventeenth century[4].

One example is a 1637 appendix to Descartes' *Discourse of method*[5]. Snow is from the same matter as water, but it is more condensed (292). Descartes observed various snowflakes as not always regular (300), and he attributed this irregularity to the violence of wind or simply air pressure (307). However, he was particularly fascinated by the hexagonal form in which "parts have a form of a starlets with six points perfectly

[3] A guess may be ventured that Anaxagoras wanted to show an example of incorrect reasoning, long before the rules of logic were discussed by Aristotle and then the Stoics. In fact, it has been suggested that Anaxagoras might have wanted to show that a certain definition of whiteness and blackness was inept and would specify snow black rather than white, Sententia Anaxagorae de nigredine nivis, *Observationum selectarum ad rem litterariam spectantium* 2(1700), p. 337. On the other hand, the statement is defensible based on Anaxagoras' everything in everything principle.

[4] For a list of dozens of snow-related publications in the eighteenth century and before, see O.L. Fassig, *Bibliography of meteorology*, vol. 2, Washington 1889, p. 298–302.

[5] R. Descartes, *Les météores* (1637), in his *Oeuvres*, vol. 6, Paris: Cerf 1897–1913, p. 229–366.

made which... are the most rare marvels of Nature" (232). Whereas Kepler saw putting together small specks into larger wholes as the way of forming snow crystals – thus so much discussion of the way space can be efficiently packed – Descartes saw the formation of regular snowflakes as the result of breaking up large clumps of frozen matter into smaller pieces which started to melt so that the melted water filled inequalities on the surface making them flat and polished after water refroze (297). As to the hexagonal arrangement, we read that cold air forms small white knots (*noeuds*) or pelotons of ice covered with hair (*poil*) since some particles of vapor did not manage to be entirely blended with others. One snow knot attaches itself to six neighboring knots by its hair and is integrated with them through refreezing because of the proximity to them (283). Descartes was later criticized that the explanations he provided were hardly in line with his methodological requirement to provide clear and distinct concepts.

2.3. Johannes Sperling

In 1639, came out *Institutes of physics* used widely at that time as a textbook in schools[6]. It was written by Johannes Sperling (1603–1658), a physician, professor of physics and a rector of the University of Wittenberg. It included a rather short section about snow to which other snow-related publications fairly often referred. As Sperling rather poetically stated, rain comes from a cloud just as hail comes from rain, so snow also recognizes the fertile cloud as its mother, since snow is nothing else than the division of the cloud into smaller parts, which is caused by the cold that turns those parts into a kind of carded wool, and sends them down in innumerable snowflakes. Its color is albinic/white, so much so that the human eye marvels at its whiteness. And so, the proximate matter of snow is a cloud, the remote matter is vapor, and the most remote matter is water (921). Snowflakes have hexagonal shape, not by accident, for the number of corners is always six, never five or seven. It appears that, as to the "always" statement, Sperling's research was not entirely thorough. In any event, he speculated that the shape was caused by the matter or snow, or by the form of the salt in it, or by the cold, or by the heat: this is extremely obscure, so that the inquisitive mind can scarcely satisfy itself. "If I were to say something, said Sperling,

[6] J. Sperlingius, *Institutiones physicae*, Lubecae: typis Gothofredi Jegeri 1646 [1639].

I would refer to matter. Experience shows and the love of the like (*amor similium*, sympathy) convinces [us] that in every congealment/freezing, parts adopt a circle as much as possible. But the hexagonal figure alone represents a circle as much as possible; not triangular, not quadrangular, not pentagonal, not heptagonal [shape]. And since the whole matter is uniform, one and the same type of figure is found in all flakes" (922). This is a statement which later authors liked to quote, although it is of a rather dubious explanatory power. In any event, when discussing the shape of heaven, Sperling discarded the five arguments proposed by others made in favor of its roundness, but just the arguments, not the contention itself (483–487). Very tersely he stated that "the shape of heaven is round. For this [shape] is the most suitable for union and conjunction" (488), and we may add, the most suitable not only for heaven, but also for what is under the heaven, including a snowflake. Roundness it is. This later oft-repeated roundness argument could actually be traced back to Kepler, particularly to his discussion of packing space.

2.4. Georg Caspar Kirchmaier and Martinus Leutmann

A small pamphlet published in 1659 is later often used for reference; it somewhat systematized what was rather obvious or what had been already said[7]. And thus, we read that "snow is a *meteorum* [a kind of precipitation], from a condensed cloud before it dissolves into rain, born like carded wool, heading for the ground" ([1]). There are four causes of snow, efficient, material formal, and final, and four characteristics (*affectiones*): place, time, brightness (*candor*), and duration. God is the efficient cause (Ps. 147:16) ([3]) and stars are secondary causes. Water is the material cause, partially also air and earth. The form is the hexagonal figure ([4]). The final cause is the fruitfulness of earth by irrigating it (Is. 40:10) ([5]). Snow also contributes to the safety of crops. Indeed, the snow protects the crops otherwise exposed to injury from the cold. It contains the vital spirit of the plants within the earth, so that it clings

[7] G. Casp[ar] Kirchmaier (*praeses*), M. Leutmann (*respondens*), *Ex physicis disputationem publicam, de nive, in Electorali ad Albim Academia*, [Wittenberg:] Literis Henckelianis 1659; there is no pagination. Kirchmaier (1635–1700) was a German naturalist and professor of rhetoric at the University of Wittenberg; there is no information about Leutmann except that he was *Teutoprona Ungarus*, a Hungarian from Deutschproben, now Nitrianske Pravno in Slovakia. A laudatory poem at the end of the pamphlet seems to indicate that Leutmann was the author of the pamphlet, although later references to it are made using the name of much better known Kirchmaier as its author.

above all to the roots, and the united force escapes stronger. However, snow has some harmful effects which include *bulimia*, an excessive appetite, which is induced by walking for a long time in the snow ([6]); also, too much whiteness of the snow can blind people and some animals, especially fowls. As to its characteristics, space: the area where snow is generated is generally the middle of the air ([7]); time: usually it snows in winter; duration: a few days, weeks, months, in some places there is also permanent snow ([8]). Brief remarks about the color of snow are included: "We deny that it is real, and that the whiteness of the snow comes from sulfur". In that respect, a distinction should be made between the color that is real and phenomenal. A real color is the quality of a mixed body, arising from sulfur. Sulfur is colored first and from its admixture various colors arise. The assumption that snow is a mixed body can be rejected: there is certainly little or no sulfur in snow since where there is sulfur, there is combustibility, and snow surely is not combustible. Another distinction should be between light in general and light in particular: in the former case, light is called color, but somewhat improperly. In the other case, light is distinguished from color. Sunbeams are not colored in a proper sense, they are luminous. The sun is by no means colored, it is lucid/bright. Also, a distinction is needed between common parlance and an accurate judgment/meaning of that speech. "Let us speak, if it cannot be done otherwise, like common people, but in the meantime, let us agree with the learned" ([11]). As to the hexagonal shape, Kepler's solution is considered absurd, Descartes' wrong, Sperling's is accepted: "of course, all nature delights in roundness. Consider raindrops and hail, and do not laugh. A single hexagonal shape usually comes closest to roundness" ([13]).

2.5. Thomas Bartholin

In 1661, Thomas Bartholin (1616–1680), a Danish physician, mathematician, and theologian, published a book on the medical uses of snow, to which many authors later referred[8]. On over 200 pages, he described various afflictions which can be treated with snow or snow water also indicating cases when that it is not a good idea. Most of information comes from other authors, including classical sources. Having expressed

[8] Th. Bertholinus, *De nivis usu medico observationes variae*, Hafniae: Typis Matthiae Godicchii 1661.

his astonishment with the form of snowflakes to the extent that "you could call them stars falling from the sky" (30), Bartholin pointed to the fact that snow, by reason of salt in it, is coagulated and thickened by the addition of external cold (38). The error of those who find nothing but cold in the snow is great, whereas it is established by many evidences, accounts, and authorities that it is warm because of the innate spirit and heat, and the heat of the earth and of other things. Snow is full of hot air (45), which is established by nine proofs (48–54). And so, snow is warm inside and cold outside, for it binds the internal heat and protects it from the external cold. The heat slumbers, is not extinguished, and rests until it has exhausted its strength when the restraint/limit is removed (54). The great importance of the warmth of the snow can be seen in the case of worms, which are born from the old snow: for no generation or vivification, even of the lowest animals, is accomplished without warmth (59). Incidentally, the problem of worms born in snow frequently returns in various authors.

Snow prevents all decay and preserves the bodies of animals for a very long time uncorrupted (77). Snow is absolutely a divine medicine in the prevention of pestilences/illnesses, both because it counteracts the putrefaction by its salt, and because, by its external coldness, it averts, extinguishes, and inhibits the high temperature of internal organs and excessive fever which generally accompany pestilence/illness and the boiling of hot humors. In addition, it prevents pestilential vapors from blowing into the ground (85). Cooling the drink with snow is a very old and universal custom; cf. Prov. 25:13 (88, 220). That snow is recommended for the treatment of many diseases, which should not be surprising to anyone, as experience has shown that snow and cold drive all harmful things from the center to the circumference (127), which is a rather underwhelming substantiation. Snow is useful in cautery and lithotomy. Before cauterizing an ulcer in the limbs, the rubbing with snow induces stupor/numbness. Snow cures fevers and colds (134), in which the active ingredient of snow is not only its outer coldness, but also its inside salts (135). Snow is useful to treat heart problems and cholera. It stirs the bowel movement and causes vomiting. It is a remedy for colic pain (138). Snow calms delirium. It alleviates the pains of the head, teeth, and eyes, and extinguishes their inflammations (146). Snow heals pneumonia (149), it is used to treat priapism (150), papules/pustules, burns, hemorrhages, aneurysm (153), podagra/gout, arthritis (157), frostbites, bruises (161), and the paralysis of the leg, arm, and shoulder (210). However, just as

even the best things have their beneficial uses, they can also bring harm, if they exceed their limit; thus, many have experienced harm caused by snow, who have used it without good reason, either externally or internally. For instance, too much and too cold snow hurts (173). It can harm the eyes by its brightness, it may become the greatest hindrance to travelers if it is too deep, by which they can be detained or even drowned (182). Snow can also cause bulimia (186).

Thomas Bartholin's book has an attachment, which is a short treatise about the shape of snowflakes written by his brother, Rasmus Bartholin (1625–1698), a Danish physician, mathematician, and physicist, professor of medicine and mathematics[9]. The author expressed dissatisfaction with some explanations of the regularity of snowflake forms and opted for Descartes' principles (31), whereby snow takes a round shape at first (32), then flat (34), then hexagonal (36). He said he had shown that there was a formative force in the clouds, and he had shown from the principles of mathematics what it was (40).

2.6. Robert Hooke

The microscope offered an incredible access to the microworld, and Robert Hooke made the microscope the centerpiece of his book, in which he put under the microscope anything he found around him and described what he saw[10]. He included a short section about snow where he said: "In all which I observ'd, that if they were of any, regular Figures, they were always branched out with six principal branches, all of equal length, shape and make, from the center, being each of them inclin'd to either of the next branches on either side of it, by an angle of sixty degrees" (91); this is illustrated with drawings of 26 snowflakes.

2.7. Gottfried Voigt

Gottfried Voigt (1644–1682), a German theologian and pedagogue, rector of Domschule in Güstrow and then rector of the Johanneum in Hamburg, published a book in which he concentrated on the color of snow[11]. Snow is a watery *meteoron* born from a fertile cloud dissolved into

[9] Idem, *De figura nivis dissertatio*, Hafniae: Typis Matthiae Godicchii 1661.

[10] R[obert] Hooke, *Micrographia*, London: James Allestry 1667 [1665].

[11] G. Voigtus, *Contra nivis albedinem realem dissertatio physica*, Gustrovii: Impensis J[oachimi] Wildii, bibl. Rost[ochi], typis 1669.

the smallest drops, condensed for the most part by colder bodies in middle air, like carded wool, heading for the ground (15). Already this definition indicates a great dependence on the Kirchmaier/Leutmann pamphlet. The following paragraphs very closely follow this pamphlet with at times very similar wording, but also adding new material. In particular, the four causes and the four characteristics of snow are introduced in the same fashion. In fact, the topic of Voigt's book was inspired by the question Kirchmaier/Leutman used as the title of one section, "Is snow white?", and apparently the answer. Siding with Sennert, Sperling and to others, Voigt considered it to be probable that the origin of colors is ascribed to sulfur. For when it is present and properly mixed, the color is present; but when it is absent, or less properly mixed, the color is absent (55). Colors of clouds do not really exist, but only seem to exist. For when the sunrays fall on a cloud of fine texture, the cloud appears whitish; when on a dense and thick cloud, it appears black; when on a watery and dewy cloud, it appears a green, and so on. Therefore, the eyes are so much clouded that people conceive such images in their mind, which correspond to nothing in reality (56). White and black are extreme colors (57), other colors are intermediate (58). But albedo is a simple and extreme color, not the result of a mixture, and it capable of receiving all other colors: whence it is also said to have power over all colors, as Scaliger stated (60). Therefore, the origin of a white color is more truly related to sulfur: it is made of the purest sulfur, the best arranged, the most perfectly worked out by nature, and completely stripped of all impurities (62). It indeed appears to the senses that snow is white, but, still, it is not really. Thus, the sky also appears to the senses to be blue, the rainbow multicolored, the sun red, and other colors appear in the clouds, which, however, are imaginary and phantasmal (65). As to the hexagonal shape of snowflakes, he referred to Sperling's roundness idea (91).

2.8. Isaac Schoock

A snow pamphlet by Isaac Schoock (1650–1681), a Dutch professor of philosophy in the University of Frankfurt is worthy of mention if only because how disappointing can be reading of some scholarly publications[12]. First, without indicating it, it includes in its entirety another pamphlet

[12] I. Schoockius, *Dissertatio physica de nive, cum rarissimis adhaerentibus quaestionibus, de meteoris aqueis*, [Frankfurt an der Oder:] Sumptibus Eichornianis 1673.

in which on the title page is mentioned his father, Marten Schoock (1614–1669), a Dutch professor of logic and physics in the Academy of Groningen and the University in Frankfurt[13]. There are some additions, mostly from Kirchmaier/Leutmann. Second, it seems to be just a rehash of by then familiar information. Schoock listed efficient and final causes (4) and was quite generous with characteristics of snow: color, continuity, levity, softness, form, coldness/temperature, time, and space (5). Many effects of snow are listed: its bright white can affect vision (10, 41); it fertilizes the fields: by being spread on the ground, it contains and fosters the spirit of the earth, which is, as it were, the vital spirit of plants, by pushing it to the interior of the earth and communicating it to the roots through their extremities (11); worms are generated in snow (12, 43); melted snow usually contributes a great deal to the growth of rivers (15–16), although too much of it can destroy bridges (22); falling snow can suppress sound (17); it is believed that snow, taken by four-footed animals in the snowy mountains, dyes their fur with an exquisite whiteness (18); it may cause bulimia (19, 44); melting snow can be harmful to the roots of plants; animals leave traces in snow, a boon for hunters (22); a weather forecast is possible with the use of snow (23). In respect to the color of snow, Schoock was on the side of its reality. Snow is white since 1) it is from a rare and transparent cloud, which is receptive to light; 2) because it is airy and the airy things turn white, as is evident in the foam; 3) cold is the cause of whiteness, as is evident by the pallor of the inhabitants of the North; 4) that snow is white is testified by the senses, which neither fail nor are deceived, whenever they tend to their proper object: for color is perceived by sight, and sound by hearing (34). As to the hexagonality of the snowflake, he sided with Sperling answering with words lifted from Kirchmaier/Leutmann: "of course, all nature delights in roundness. Consider raindrops and hail, and do not laugh. A single hexagonal shape usually comes closest to roundness" (38).

2.9. Donato Rosetti

Some systematization of snowflakes was undertaken by Donato Rossetti (1633–1686), an Italian clergyman, scientist, and university

[13] M. Schoockius (*praeses*), Arnoldus à Stralen (*respondens*), *Disputatio physica de nive*, Groningae: tygis [typis] Augustini Eissens 1646. It is only known that Arnold van Stralen was from Bommelia (now Zeltbommel in Gelderland in Holland).

professor[14]. Right on the first page, he specified five kinds of snowflake forms: *bruscolo*/blade of straw, *fiocco*/flake, *punto*/point, *rosetta*/rosette, and *granello*/grain/globe. He also divided snowflakes into white (*gelo alabastrino*) and transparent (*gelo cristallino*) (1) and later he specified eight kinds of rosettes named after similarities with plants, math figures, etc. (19). "The largest of the Rosettes have a diameter that even exceeds the third part of the width of a finger, and then they are found to be of every smaller size even to such minuteness that, although they are placed and close to the naked eye, it is hard to see them" (5). This is why Rosetti used extensively the microscope for his observation made in the six years spent in Turin (7). The most important and most frequent are rosettes and in the rest of the booklet he provides meticulous descriptions and reports of his observations with numerous drawings. By providing these descriptions, Rosetti was certain to show that "Nature, to form the Snow Rosettes, easily turns their components in its hand in joining them in its own manner, which is certainly artificial/purposeful; and in adapting them in its construction, which is certainly belabored; and belabored so admirably that it certainly deserves to be numbered among the most marvelous constructions that are known to be made by Nature" (18).

This was pretty much the scholarly status in snow research at the close of the seventeenth century and nothing much changed through the eighteenth century. Basic characteristics of snow would remain the same, its medical uses would not go far beyond Bartholin, its role in nature would be the same, and the origin of the most puzzling aspect of snowflakes, their shape, particularly the hexagonal shape, would very much remain mysterious and as puzzling as it was for Kepler. This mystery not only prompted further scientific investigation, but it also led to theological reflection.

3. The theology of snow

The mystery aspects of snow not only prompted further scientific investigation, but it also led to theological reflection.

3.1. Martin Pezold

At about the same time as Kepler published his snow investigations, the first large religious reflections on snow were published by one Martin

[14] D. Rossetti, *La figura della neve*, Torino: Per la Vedova Gianelli e Domenico Paulino 1681.

Pezold from Bürgel, a deacon in Eisenberg[15]. He realized that he was a trailblazer in that respect since he remarked in the preface that nothing theological had been published concerning snow (Vorrede [25]). Having approvingly quoted Basil who called the world God's school (4) and Johann Stigel who said in his elegy that "the divine power shines from the earth itself, and the grass is light which proves that it is God" (5), Pezold added that each creature speaks about the wisdom, power, and omnipotence of God (4) and that He is a great, powerful, wise, merciful and good God since He can beautify the earth all year round (13): in spring, He covers the earth with green covering; in summer, with multicolor cover which changes color almost every day; in fall, with the covering that is brown and black, and with white snow in winter (14). Since his interest was in snow, he very briefly included some physical information about it: the material of snow is called *meteoron* (21) meaning that it is created in the air (22); snow is a vapor rising into air and condensed by cold into small clouds like wool and coagulated falls down, which Pezold learned from Aristotle (24), but God is its primary cause (25). Nature points to the majesty of God (29), to His omnipotence (30), and to His wisdom (32), and, in particular, God can do wonderful things with just one snowflake: when melted, it turns into wine through vine, into grass or flower on a meadow, or into fruits on a fruit tree. Nature points also to God's goodness (33), and so, for instance, snow can stop the enemy (50). But then, for the most part, Pezold used snow and its attributes as theological and moral lessons.

Snow thaws when warmed by the sun, so we should remember that human life passes away (36). A sled ride on snow that covers everything, including graves, is pleasant, and so, death can be a joyous ride to heaven for a pious heart that wants to be with Christ (54). The divine majesty is represented in the Bible by white clothing, so white clothing describes the glorification of Christ (73), His innocence/sinlessness (74), also the future glory of the eternal life (79), since the white clothing of Christ covers all human sins (80). However, the very same snow can lead into the opposite direction. Pezold knew Anaxagoras' opinion that snow was

[15] M. Pezoldus, *Gottes weisser Mann und Winterkleid, Das ist: schöne anmuhtige Christliche Schneegedancken von den oberauß gefallenen Schneen, sonderlich dieses 1624. Jahres*, Jehna: Johann Weidner 1624. He also remarked about himself in the preface that he was for eight years in university and thirteen in ministry (Vorrede [28]), being a deacon for ten years ([30]).

really black, which, in Pezold's view, was an opinion stemming from an ice-cold snow-heart, the heart which is not white and bright, but black and repulsive (86). One brother oppresses another, one friend betrays, cheats, and deceives another (88). Such ice-cold, snow-love is rampant (89).

In common life, love cools down and becomes like snow that turns into water and people should not count much on an improvement in this life and how awful is the devilish "Kipper und Wipper" scheme, the debasement of money by shaving off edges from coins, which completely sucked the marrow out of the poor people's bones, robbed churches, and stripped poor widows and orphans completely naked (95–96). Such people are worse than animals and they will end up in hell (96–97). They are worse than vipers (101–102): vipers transform balsam into poison. And so, debasers use the balsam of the word of God, go to churches and present themselves like the devil who shows himself as the angel of light (102). Debasing money is worse than suffocating a person (108). Debasers are worse than ravens which feed on corpses, not on living bodies, but usurers do not spare the dead and the living (109). They are worse than devils (110). So, it started with melting snow to lead to a dozen pages of philippics against money cheaters.

Star-like snowflakes, *stellula* (121), point to "the beautiful heavenly blue palace" to seek Christ who is on the right hand of God (Col. 3:1) (122). Consider a snowflake and learn how this starlet beautifully shines in the sun, and so allow your life to be changed and let Christian virtues shine in you: be the light of the world (124–125). A starry snowflake so wonderfully made in middle air shows the wondrous majesty of God and proclaims His glory and remember that God wonderfully created you (126).

Snow beautifies the ground, so people should beautify the church with the fear of God. Before snowflakes reach the ground, they are in a steady fall, so a person should steadily fall/pass from one virtue to another on God's way (127). Snowflakes eventually melt and seep into the ground, so passes away the glory of this world and the body returns to earth from which is was taken (128).

Snow can sometimes look like gray ash, which allowed Pezold to use ash for his analogies and to say that Abraham called himself ash and dust (Gen. 18:27), which reminded Pezold of the saying, why do the earth and ash extoll themselves if they are just shameful filth (Syr. 10:9–10), which led to Augustine's statement that "after man is a worm, after worm there is stench and horror, so every man is turned into a non-man" (129), which

eventually led to the conclusion that all that comes from the earth must come back to earth, including the human body (130). Just as the legendary phoenix rises from ashes, so Christ can raise each person from this person's ashes. Just as glass can be made from ashes and salt, so Christ can raise transfigured bodies from human ashes (134).

The birth of Christ is celebrated in winter so that the ice-cold snow-heart should turn to the newborn Christ to have and carry a warm faith-heart toward Him (140). The human heart is the shrine in which Jesus should reside: true faith is His pillow, the love of God and of neighbor is the coverlet, the trust in God is mattress, and the sheet is the life that shines before people (148–150).

Too much snow is harmful to people and animals (153), which is a punishment and the rod sent by God (157) and Christians should consider such unusual snow to be a repentance-preacher (19). People should earnestly pray to God to end the punishment like too much snow and be willingly obedient (181). God punishes people for their avarice, as in the case of money debasement (185); for pride and arrogance (192); for tyranny and the persecution of Christians as with too much snow to hinder the enemy (193). Augustine was right to say that there is nothing so bad and harmful that God could not use it for good, so it is with snow (160). And so, snow makes the earth fruitful after water coming from thawing snow sinks into the ground (161). Snow protects seeds and roots in the ground from cold (167), it brings to the roots of trees "the force of the earth" (172). Snow praises God's wisdom, goodness, and omnipotence just like all creation and so people should give thanks for everything (179). Snow preaches about the grace of God and His goodness shown every day (199), in forgiving all sins so that people can be white as snow (201); in eternal life when people will stand before Christ in white clothing (202–203). Pezold also included some 80 pages of historical records of heavy winters.

As the title of the book states, Pezold's are Christian snow-related thoughts. And thoughts, indeed, they are, although not necessarily snow related. As the example of money debasers and one about ash indicate, there is some stream of consciousness element here at play. One thought leads to another and the beginning has nothing to do with the end. In this, snow plays quite often a very little role, in fact, the reference to snow is frequently expandable. When speaking about sinlessness, white color was important as its symbol, much less snow itself. It is white all right, but so

is a lily or a swan. In the budding physico-theology, nature was used as an argument for the existence of God and for the specification of His attributes. There is some of it in Pezold, but to a considerably lesser extent than the use of elaborate rhetoric to make spiritual points, which, many a time, would be much clear without resorting to a rhetorical flourish.

3.2. Johann Gabriel Drechßler and David Geisler

One snow-related event became a subject of an interesting small pamphlet[16]. The belief that snow can bring worms was quite widespread, but in 1672 near Neusohl (now Banská Bystrica in Slovakia) this occurred to the pestilential level bringing worms "of various forms, hideous and abominable", as an accompanying illustration testifies (6). The authors were interested in the natural and supernatural aspects of the event since, in their view, even extraordinary events should be approached in a naturalist fashion: on the other hand, "we must stay away from impiety and false sense of security, so that we do not immediately pronounce all merely natural things, for the most part rashly" (4). There is nothing unusual here, if we consider either the time, or the place of the falling snow, or the snow itself (7). The authors draw three conclusions: 1) It is possible for worms to live naturally even when covered by snow (8). 2 Worms may fall together with snow from the sky. Insects are often associated with prodigious rain. Now snow and rain meet for the most part, and snow is made from raindrops. That with rains descend sometimes living beings (*beastiae*) and other matter, is sufficiently clear from history (9). 3) Worms can be poisonous under snow (11): when the worms are being born of that snow, or at least they are covered by it, and are nourished by its water, they will easily inhale poison contained in exhalations coming out from the ground which are impure and frequently cause diseases (12). Is this event an omen? What are the meanings of each of the portents? This is not known with certainty, because of their rarity. Old remembered omens must be taken only by conjecture and their effects should not be generalized (16). Not knowing what particular signs mean and what times the just and merciful God appointed for people, they should fear evil, but they should hope for good. People should follow Louis the Pious, a son of Charlemagne, who, when he had been ter-

[16] Joh[ann] Gabr[iel] Drechßler (*praeses*), David Geisler (*respondens*), *Discursus curiosus at sobrius de nive prodigiosa*, Lipsiae: typis viduae Johannis Wittigan 1673.

rified by the appearance of an unusual comet, and had thought with his mathematician/astrologer that the change, the kingdom, and the death of a prince were thereby signified, mindful of Jeremiah's statement about not being afraid of the signs of heaven, he said: I do not fear anyone else, besides Him, who is the Creator of us and of this star, yet I cannot sufficiently praise and marvel at his mercy, who deigned to warn us of our indolence by such signs (19).

3.3. Christian Philipp Leutwein

The close of the seventeenth century saw an appearance of *theologia nivis*, at least the intention of snow theology as announced in the title of his book by Christian Philipp Leutwein (1652–1728), a German theologian, who studied in Altdorf, Strasburg, and Tübingen; in 1676, he became a Hofmeister in Pfedelbach, in 1683 a pastor in Gronau near Bensheim, in 1690, and a court preacher in Waldenburg (the Hohenlohe)[17].

God's creations are the tools which help an unbeliever to recognize the true God and to glorify Him when they find Him (Vorrede [5]). A Christian is obligated to diligently read the book of nature since it is written in the divine writing and God made His creatures to be teachers ([10]). God points to the investigation of His creation to recognize in His wondrous creation the Creator of all things whom they should praise, love, and obey ([22]). That is, an unbeliever can be led by the study of nature to the recognition of the existence of God, a Christian can be led to a deeper appreciation of God's attributes. Can an unbeliever become a Christian just by the study of nature? Not quite. The book of nature does not lead that far. Without faith it is impossible, the eternal life is reachable only through Christ ([23]). The natural knowledge of God is not more than an elementary school, an ABC-knowledge of it that should lead to the Word. A master learned in the book of nature must become a pupil in the book of Scripture ([24]). But the book of nature should not be neglected as the source of the knowledge of God. God gave the book of nature for people to seek Him and when they find Him, they should praise and thank Him. Christians should see heavenly matters in natural images ([25]). For a Christian, the world is

[17] Ch. Ph. Leutwein, *Theologia nivis physico-mysticae dogmatico-practica; das ist: geistliche Lehr-Schul vom Schnee; oder christliche Schnee-Betrachtungen*, Nürnberg: Wolfgang Moritz Endter 1693. For some information about Leutwein, see J.Ph.W. Luck, *Versuch einer Reformations- und Kirchen-Geschichte der Grafschaft Erbach und Herrschaft Breuberg*, Frankfurt am Mayn: mit Andreäischen Schriften 1772, p. 124.

a big book with many pages filled with letters of God's love and goodness, a scene on which God's omnipotence and wisdom are displayed, a big church in which sound a lovely harmony and hymns of praise sung by His creation, a school in which there are as many teachers as creatures that include the sun and the moon, but also grains of mustard-seed, blades of grass, and, indeed, snowflakes ([26]). Leutwein knew the many naturalist treatises on snow, he also knew Pezold's book and he wanted to continue along these lines to induce in Christians spiritual thought through the reflection about snow ([29–30]).

Leutwein was following Paul's statement concerning the possibility of every person acquiring some knowledge about God from the investigation of nature (Rom 1:19) (96). Epistemologically this was possible: the first parents by their sin lost the image of God and with them, all their progeny, intellect became erroneous and dark, will had an inclination to evil, and affects became sinful[18]. However, human abilities retained some of their power, and so intellect is able to distinguish good from evil and to recognize that God exists.

In the description of the physical nature of snow, Leutwein simply followed published reports. Interestingly, as to the whiteness of snow, he did not think it was real, which led to the explanation that the Bible says (*gedencket*) that snow is white, but it does not thereby settle (*setzt*) that it is really white; just as light is said to be white, because of the apparent color (*Schein-Farbe*) so it is with snow and the Bible sometimes describes something not the way it is in itself, but according to human understanding and according to how it appears to the senses (20). Incidentally, this was a kind of widely used approach in interpreting Biblical statements in the defense of the Copernican system. Curiously, Leutwein sided with the literal interpretation of the Bible by saying that David knew more about nature and the courses in heaven than Copernicus, Kepler, Galileo and others who deny that the sun is moving. It is better to be amazed by the fast motion of the sun than deny the statements of the Scripture. Humans do not know more about the motion of created bodies than the Creator Himself. There are also clear scriptural statements that the earth is still[19].

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[18] Ch.Ph. Leutwein, *Herr Gott Zebaoth, tröste uns...! Der seeligmachende Glaubens--Grund sich zeigend in der Seeligmachenden Ankunfft Jesu Christi in die Welt*, Pfedelbach: Johann Gottfried Memhardt Buchdruckern 1712, p. 14–15.

[19] Idem, *Das Buß-weckende Erdbeben, welches A.C. 1690 den 24. Nov. zwischen 3. Und 4. Uhr Nachmittag... angeschlagen*, Nürnberg: Wolfgang Moritz Endter 1691, p. 7–8.

Leutwein said that God impressed on His creation the traces of His omnipotence, wisdom, goodness, and justice (97). People should conclude that everything around was created by God since nothing comes into being by itself (98), and it must be concluded that God is eternal (99). The problem of the possibility of the eternity of the world well discussed in the seventeenth century was not raised. God also created snow, in which God's wisdom should be recognized (100). God's wisdom appears to be indicated by the fact that "snow melts when, how, and where it pleases God the Lord, its Creator" (69), which, in turn, stems from the idea that cold causes snow, but the primary cause is God who governs all of nature causing, in particular, the coldness of air. It appears that the wisdom and power of God are starting points of Leutwein's investigation, apparently requiring little theological justification.

Although Leutwein seems to have downgraded the color of snow to a trick of the senses, its whiteness became very real and the most prominent property of snow when it came to drawing spiritual lessons. In the Bible, snow is a symbol of holiness, innocence, justice (Ps. 51:9, Is. 1:18) (152), but also the white purity of snow represents the purity of God's law (182). For a Christian, snow should invoke a thought of an angel, good or bad, snow invokes the thought of the white clothing of angels (141) and they appeared to women in shining clothing after the resurrection (Lk 24:4; Mt 28:3) (142). This clothing indicates their purity and holiness (146). Christians should remember the guarding angels that daily guide and protect people from evil (149). Also, the entire life of a Christian is a constant repentance, the daily washing off sins without a prospect to be snow-white (278). A person can become white as snow and be again in the likeness of God through the power of Christ's self-offering (180).

It seems that Leutwein was carried away when after quoting Ambrosius who spoke about Adam's covering of virtue and vestment of grace, he asked rhetorically, could Adam have worn snow-white clothing? (158), in spite of the fact that, by the Biblical record, Adam was naked in the state of innocence, which of course, he, a clergyman, knew[20], then why use such rhetoric?

The meditation on snow can lead to the meditation on the last supper. Snow should invoke also the idea of the snow-white communion

[20] Idem, *Getreuer Seel-Sorger geistliche Seelen-Apotheck*, Nürnberg: Wolfgang Moritz Endter 1707, p. 63.

host which is like white manna, heavenly bread which is sacramentally united with the purest body of Christ, the bread of life, which came from heaven to become the spiritual meal of the soul (340–341).

Leutwein listed many by then familiar uses of snow: snow embellishes the world; it purifies air (28); it makes earth fruitful (29); it protects seeds in the ground from freezing (30, 136); it destroys some worms (34); it brings some quietness; it hinders enemies from progress (36, 524, 643); it allows hunters to easily track animals (36); it alleviates some health problems (37, 541–542); it is often used with meals (37); with snow, air can be turned into water (39). These various uses should teach people. And thus, a Christian must be fruitful through his good works, to serve others with his gifts. This teaches him snow which serves not itself but people by providing moisture for the earth so that it can be fruitful (274–275). From another angle, just as snow moistens the earth to make it fruitful, so the marriage was instituted for people to multiply and fill the earth (382–383).

Most importantly, through its various uses, snow praises God (Ps 148:8) and the praise of all creatures is that they do what God designed them for, namely, they are useful for the pious and serve as punishment of evildoers (41, 128). Thus, the usefulness of snow, which was discussed also in naturalist publications, is used as a theological argument for God's providence (132). This usefulness extends to the situations in which some aspect of creation, including snow, are considered harmful, which leads directly to the problem of theodicy. The customary answer was that God uses various events as a punishment of sins, in particular, in respect to snow, when it does not snow when it should; when it snows too much; when it destroys property and covers all ways; when snow stays for too long (43, 617); when it melts too quickly causing floods (44).

The majesty of God is manifested in all seasons through His creation, including snow in winter (481): "small snowflakes, artfully formed snow-stars, testify about great wonderwork of the Most High who made them so wondrously in air" (482). It is quite puzzling that, arguably, the most interesting property of snowflakes, their shape that was very often hexagonal, was barely mentioned by Leutwein. He also said that six-cornered snowflakes fall down like small stars, so people should raise their hearts to heaven above the stars to become newborn Christians (510), but he did not say anything else significant about the shape of snowflakes, unsatisfactorily explained by Kepler (23) and Descartes (25), and thus a very

mysterious entity from the naturalist point of view, and yet, Leutwein did not make much theologically of this form.

Leutwein believed that there were many spiritual lessons that snow could teach people. Snow points to the Scripture (71). Snow comes from the sky, God's Word comes from God (73). Snow is of modest origin, just frozen water and is despised, so Christ was despised appearing insignificant (75). Snow has inner power by making earth fruitful (76), so God's Word is powerful (77) and it should be spiritual nourishment (521). The Gospel of Christ is spiritual snow, the power of God that brings blessing (82). The Word should be read and should penetrate the heart and soul and fill them with "the divine snow power and with heavenly consolation and holy thoughts" (84).

Thoughts about snow can lead to thoughts about death (401). Snow melts and sinks into earth, so does a man who was created from earth and is a snow-man who turns into earth after death (402). Baptism is an entry through death to the future eternal life (406). Snow teaches about the resurrection of the dead. Molten snow turns into water and this water is again drawn by the heat of the sun up into the air as vapors to turn again into snow so the body of a dead person is resurrected for the last judgment (415–416), but unrepented sinners go into the eternal fire (423).

To fill out hundreds of pages of the book with snow-related spiritual thoughts, artificial or even weird reflections are not infrequently proposed. For instance, the high authority is a high snowy mountain (349). Snow thaws on mountains as everywhere else, so princes are mortal just like other people (351). Thawing snow flows down to valleys to moisten the earth (352), so a good prince helps his subjects (353). Marriage is a holy snow-white order of God (363). God gives snow like wool (Ps 147:16), so is snow a gift of God and so is a good wife (Syr 26:3) (367). Winter hardens elements: the earth, water, air (379), but it also beautifies the landscape (Syr 43:18–20), so marriage is not always joyous spring, but also cold love or snow-love, when some domestic problems arise like heaps of snow (380).

As snow is in summer, so honor is for a fool (Prov 26:1), which can be also understood that just as snow is out of place in summer, so it is inappropriate when in marriage there is a big age difference (389), or difference in religious beliefs (391).

The large number of snowflakes when it is snowing may direct thinking to a large number of the damned (461).

Snow makes a sound when one is walking on it, so evildoers gnash their teeth (492).

The shine reflected from snow on a sunny day invokes a reflection on the clarity of the Gospel (194).

Snow incites a Christian to the reflection about sin (160) even though sins are signified by a red color (222).

Snow can represent the situation of the church on earth. The church is the bride of Christ. As Christ appears in snow-white clothing, so He clothes His bride also in snow-white garb by washing all sins (303).

Only imagination can stop the author in inventing various associations. In winter, snow can cover impurities visible after it melts, so there is some hypocrisy hiding the lack of faith (312), but God sees the hearts of people (313, 540); snow eventually melts, so the marriage also melts in that one spouse dies and the other spouse wears black to indicate the end of white snow (395); snow melts when the sun shines, so the truth stays, the lie passes away (488). In warm weather snow melts to moisten the earth and make it fruitful, so should the human heart melt to help others (489); even long-lasting snow in mountains melts, so people should not rely on their own purity and righteousness (552).

Finally, it seems to be theologically rather far out that as an analogy to represent the Trinity he used water, ice, and snow, three things of the same essence (109).

Melting snow signifies the downfall of the world (445). At the last judgment the earth will melt by fire like a snowball (447). It will be turned not into ashes, but in nothingness just like it was created out of nothing. Also, time and place/space will cease to exist. All of nature will cease to be, the sky and stars (448). This marginal reflection about the nature of the last judgment is Scripturally puzzling, since Leutwein seems to have denied the reality of the future new heaven and new earth and the new Jerusalem. They all are seemingly folded into heaven. This is indicated by the statements that the shine of snow illustrates the splendor of the elected in heaven (451). The elected in heaven are shown in white clothing (452), that is, the saved will enter into uncreated new heaven and uncreated new earth for perfect eternal happiness[21].

And so, it goes on for hundreds of pages. Leutwein took a cue from Pezold by concentrating on using snow as an avenue for spiritual lessons.

[21] Idem, *Das Buß-weckende Erdbeben*, p. 11.

Pezold's book came out near the beginning of the seventeenth century, Leutwein's hefty tome came out at its end. In the middle of the century, however, physico-theology started very strongly, which is even marked in the titles of books published by Walter Charleton in 1652 and by Samuel Parker in in 1665. There is some of physico-theological reflection in Leutwein, but he somehow felt compelled to see in all aspects of snow a way of deriving some spiritual lesson, which was frequently done quite artificially and proving more Leutwein's inventiveness and his rhetorical prowess than any spiritual profundity. This was for the most part rhetorical showmanship and it is doubtful if it could touch the hearts of readers and bring them to repentance of their sins and correcting their lives.

3.4. Christian Gottfried Gräfe and Johann David Frisch

In the new century, the theological interest in snow still remains strong, but the use of snow to show one's rhetorical acumen is used less prominently and sometimes it even disappears from the view. A very good example is a sermon preached by Christian Gottfried Gräfe (1664–1733), an archdeacon of the church in Wurtzen/Wurzen[22]. This is a sermon based on Job 38: 22–23: Do you know where snow comes from, and hail, which I keep for the time of distress, quarrel, and war (5)? Snow is a cold half-frozen watery vapor and dust or frail water cloud which is divided by the sun into a large number of drops, it is a watery *meteorum* coming from a dense cloud before rain comes from it; it comes in the form of six-cornered snowflakes (12). Naturalists say that snow is formed in middle air (15). They also say that snow is good for trees and seeds since it drives back their animal spirit and keeps it in roots with their moisture. Water from snow has medicinal properties; snow moistens the earth and makes it fruitful (7); it protects plants in earth from freezing (8). Snow comes primarily from God as the ruler of nature (23). God uses snow as a punishing rod when too much snow hinders travel in winter, when it stays for too long, or when it melts too quickly causing floods (25). God uses snow to punish ungrateful people with distress, war, and plagues (20). Although Gräfe referred to Leutwein several times, he stood away from

[22] Ch.G. Gräfe, *Gottes Majestät und Herrligkeit bey dem Ungewöhnlichen grossen Schnee, der am 25. May dieses lauffenden 1705ten Jahres gefallen, und sehr großen Schaden gethan, Seiner anvertrauten Gemeine zu Wurtzen in einer Wochen-Predigt... gezeiget*, 1705. About Gräfe, see Christian Schöttgen, *Historie der Chur-Sächsischen Stiffts-Stadt Wurtzen*, Leipzig: Johann Christian Martini 1717, p. 356–357.

Leutwein's use of snow metaphors, similes, and the like. Naturalist aspects of snow come out very strongly, but, ultimately, God's work is seen in all of it, particularly His punishing hand, the focus of this sermon. In the same spirits is a somber sermonic repentance message of a German clergyman, Johann David Frisch (1676–1742), based on Ps 147:17: Who can withstand Your frost?[23]. From the breath of God comes frost (Job 37:10), by God's will blows the north wind that brings snow and ice (Syr 43:18-32) (7). When God wants to show people His power, He arms creatures against them, when He wants to exercise His justice, He sends plagues to them, and so, when a plague/disaster comes, such as an unusual frost, people should repent so that God's grace could return to them (8). When people's hearts are cold, they should turn to the heart of Christ that burns of love and of the desire to save people (10).

3.5. Balthasar Heinrich Heinze

The eighteenth century was an age of flowering physico-theology which was reflected in the proliferation of the names for the many subdivisions of pysico-theology: there was astro-theology, bronto-theology (the theology of thunder), petino-theology (the theology of birds), etc. and there was also chiono-theology, the theology of snow, the name introduced in the brief treatise by Balthasar Heinrich Heinze (1665–1744), a German clergyman, deacon in Droskau (now Drożków in Western Poland), since 1687, pastor in Laubnitz (Lubanice in Poland) since 1699, and pastor in Triebel (Trzebiel in Poland) since 1706[24]. However, he clearly relished in the use of rhetorical devices in the style of Pezold and Leutwein his justification being that since the Scripture uses snow in similes and analogies and the Holy Spirit "often brings golden apples of heavenly things in silver vessels of snow images", why shouldn't we do the same and present invisible things through visible snow (13)? Some of his spiritual conclusions are awfully similar to Leutwein's. So, we read that the clothing of Christ and angels is presented as white as snow. People should become pure as snow (6). Snow is white from pure

[23] J.D. Frisch, *Heilsame Winter-Gedancken, über die Worte Davids Ps. 147,17. Wer kan bleiben vor seinem Frost?*, Stuttgardt: Daniel Benjamin Faber [1740]. About Frisch, see Christian Gottlieb Jöcher, *Allgemeines Gelehrten-Lexicon*, Leipzig: Johann Friedrich Gleditsch 1750, vol. 2, col. 768.

[24] B.H. Heinsius, *Chionotheologia, oder erbauliche Gedancken vom Schnee, als einem wunderbaren Geschöpfe Gottes*, Züllichau (Sulechów): Gott[lob] Benj[amin] Fromman 1735. About Heinze, see J.F. Conradi, *Kirchen-, Prediger- und Schulgeschichte der Herrschaften Sorau und Triebel*, Sorau: Winkler, Görlitz: Unger 1803, p. 135.

sulfur which is hidden in it and shining because of reflected light (19) so that is can blind someone and is visible even at night in which the finger of God can be recognized (20). And so should our faith be, white because of the innocence and righteousness of Christ (21). A Christian should think about himself as a seed that is in the ground that is covered by snow to protect it from freezing, but it sprouts in spring, so the human body which is from earth will be renewed in the last days (33). With rather great theological boldness, Heinze said that "Snow, water, and ice are three / And yet they are one", they are of the same essence, so they represent the Trinity (48).

There are some physico-theological statements as well, although made rather sparingly. Snow is formed in the air or in clouds from sulfuric vapors that rise into the air and are condensed in clouds which are pressed to give out drops of water which are being formed into snowflakes (17–18). "My heart!... / Consider snow, see God's omnipotence, / Here's the hand of wonder that can create anything". No man can grasp how skillful nature is in forming snow, so a Christian contemplates what can be seen in the incomparable beauty of snow (19). Also, consider single snowflakes. It must be a Master who in one instant forms from raindrops such an immensity of various forms even if they can melt in a short while (29). They are tiny mirrors in which is reflected the omnipotence and wisdom of God. The forms of snowflakes are so accurate as though they were made by the most skillful mathematician. Consider the best artist in the world; he would not be able to created such tiny stars (30).

Chiono-theology was apparently a catchy name, since it was also used in the title of an anonymous book with snow inspired thoughts related to theology, history, philosophy, medicine, and morality[25]. To shame the blind reason of the many naturalists and atheists, some scholars try to lead people "from the external to the internal, from the visible to the invisible, from the corporeal to the spiritual, from the nature to grace, from the creation to the Creator" (3). On the one hand, he mentioned Pezold (5) and Heinze (6), but he apparently meant their snowy rhetoric, which he followed. And thus, we read that snow which is today and

[25] Anonymous, *Kurtze zufällige und vermischte Gedancken, über den hefftigen Schnee und Frost-Winter, MDCCXL. Nach Theologischer, Historischer, Philosophischer, Juridischer, Medicinischer und Oeconomisch-Moralischer Betrachtung, als ein Plan zu einer völligen Chiono- und Chimono-Theologie (einer Schnee- und Winter-Theologie) Gelehrten zu weiterem Nachdencken, anderen aber, zu einem so erbaulichen als angenehmen Zeitvertreib entworffen*, Tübingen: Johann Georg Cotta 1740.

melts tomorrow speaks to the fast and often unforeseen end of life and the ignorance of when the last hour can come. The whiteness of snow should bring to mind some divine truths (10). Angels are shown in white cloth and so was Christ and glorified people, in which the state of purity is symbolized by the white color. Snow shines when it reflects light so should Christians shine before people (11). Snow in cold winter can be useful but also harmful. And so, spiritual gifts of people can be used usefully or harmfully (12). Snow is useful by moisturizing the earth thereby making it fruitful. It also protects seeds and plants from cold, so hard snow and winter air, that is, some woes, should chastise human flesh to preserve it for eternal life (13). This type of reflection is what he understood by theology. He referred to Derham, Fabricius, Lesser, and Rohr as scholars who led people "from the creation to the Creator", but it is quite uncertain whether he consulted their books, since the type of physico-theological reasoning that can be found in these authors is hardly present in this anonymous author's book. He stated, for instance, that God's majesty, splendor, omnipotence, goodness, and righteousness are reflected in snow (8), but there is no justification of this claim. No new idea is proposed concerning theodicy: he said that excessive snow and cold in winter are directly caused by natural causes, but indirectly by God being sent as a punishment for sin (13, 53); therefore, people should not complain about excessive weather in any season (85), since such weather is a punishment for sins (86); thus, in particular, people should diligently do what belongs to them as good as the situation requires (87).

3.6. Jan Engelman

The best embodiment of chiono-theology was provided by a Dutch amateur scientist, Jan Engelman (1710–1782), in his book, *The right use of the contemplation of nature, sketched in a treatise on snow figures*[26]. He knew some leading physico-theological authors: Nieuwentijt, Derham, and Ray (6), and provided an excellent mixture of naturalist knowledge based on the state-of-the-art science and theological ideas that can be based on it, with no use of rhetorical embellishments. For Engelman, the

[26] J. Engelman, *Het regt Gebruik der Natuurbeschouwingen, geschetst ir eene Verhandeling over de sneeuw Figuuren*, Haerlem: Izaak van der Vinne 1747; about Edelman, see B[ert] C. Sliggers, Honderd jaar natuurkundige amateurs in Haarlem, in: *Een elektriserend geleerde. Martinus van Marum (1750–1837)*, eds. B. Theunissen, A. Wiechmann, L.C. Palm, Haarlem 1987, p. 77–80.

reason to investigate snow is to derive from the creation of God a lofty idea of the admirable perfection of the great Master of the universe and to bring people to their service of God; to show how naturalism is needed in forming the proper idea of the Supreme Being (5–6) since it is absurd to him to see that snowflakes result from a random configuration of particles (10). The goal of philosophy is to study the causes of things for them to be useful, which is the purpose of God in creating them. In this way, people can learn about God's wisdom and His infinite goodness and by acquiring more knowledge deepen their appreciation and enjoyment of the perfections of God (11–12).

Engelman analyzed in detail the physical aspects of snow which "consists of thin translucent neatly formed smooth clear tiny ice-plates/needles" (14). Interestingly, since snow is made in the atmosphere from frozen particles of water, there is something in the atmosphere which freezes them, something that coexists with vapor, some ice-forming particles that can be called freeze-parts (*vries-deelen*) (35). As to the forms of snowflakes, Engelman supposed that there were several laws of snow-figure-formation, and if one puts them all together, insofar as they are compatible with the others, a whole series of snow-figures will unfold; but the author did not go any further since it would be too much for him to trace them figure by figure by trying to apply those laws to each (110). However, an orderly formation of snowflakes in midair may not proceed unperturbed, so winds, and other disturbances of vapors, which get into a turbulent movement in the atmosphere, which happens often enough that very few properly arranged snow figures are discovered (111).

According to Edelman, no one who considers the works of nature with an impartial eye will be able to deny that everything is so connected that one thing is about the other; so that nothing could be taken away from nature, but there would be an absence of things, which were otherwise useful one to the other, but would now appear useless by this removal (113). To see the usefulness of snow, it can be argued that by taking away snow from nature, there would be a gap in nature, so that many things would become useless, from which much use is otherwise drawn; this would be an argument that this usefulness was intended by an infinite, mighty, wise, and merciful Being, that is, they are the purposes of God – unless it were said that an infinitely wise Being would not have known all that is good, the infinitely merciful Being would not will all that is good, or the infinitely mighty Being might not be able to create

all the good He wanted, which is absurd (113–114, 142). The usefulness of snow can be analyzed in respect to the earth, to people, and to God, and Edelman proceeded to present very systematically the various uses of snow. And so, for instance, its use for the earth is divided into the situation when snow hangs in the air; as far as it falls; and as far as it lies on the ground (115). It seems that this relation to the earth should be understood as the physical aspect of snow properties; this also includes people, for instance, the medicinal uses of snow (in which Edelman simply referred to Bartholin (134)) and the fact that snow protects crops from freezing (126), which has an obvious benefit for people. As to the usefulness of snow for people, Edelman focused on its esthetic aspect, and thus people are delighted as often as it snows since they can admire the beauty of snowflake figures (141)[27] – never mind that there may not always be an overwhelming number of pleasing shapes because of disturbances caused by winds. The usefulness of snow in respect to God is inextricably connected with humans since the properties of snow serve as the means of ascending from the creature to the Creator (142). From the investigation of snow – and of the rest of nature – people should conclude that there is an infinitely free-powerful, prudent, benevolent, single, independent, immutable, eternal, necessarily existing Being, who has in itself the sufficient ground of the existence of the world, which Being we call God (148). Snow teaches people that God loves all that is good and all good alone, so it teaches them that it would be contradictory that He should fail to show that it is His will that His rational creature should also love only what is good, which leads to the conclusion that God is just (154), and thus, to the recognition of the two ground rules: people should be obedient to God (158), and they should acknowledge that they are a creation of God, nothing more (160), and all goodness is grounded in God. This, in turn, should lead people to the acceptance of these principles: walk humbly and lowly before the Lord who made every person; do not rely on creatures as a source of happiness; bring back to God the good that was received from His creation; seek God in the signs which He has put in things to recognize His majesty, and thus, to praise Him; and do not misuse God's creation (161). Moreover, when recognizing God's omniscience, people should never regard the works of

[27] Engelman included in his book drawings of 270 snowflakes which truly testify to their beauty.

God to be small and should see them as wisely fit together; they should acquiesce in all that God does, that is, approve of everything that happens by the divine Providence (162); they should be strengthened by the hope of eternal life (164). This, presumably, should help people to deal with harmful aspects of the physical world. Thus, on the similar note, people should recognize that they owe everything to God's mercy, including the fact of their existence and everything which enables this existence; in all things, God leads people to take delight in Him in his adorable attributes (171); they should express gratitude to God; that is, show by their thoughts, words, and deeds that they hold God to be the source of all the good which they have enjoyed, enjoy, or may enjoy; they should put all their trust in God, that is, awaken in themselves that joyful disposition of the spirit, by which they steadfastly imagine that they will be happy under the divine provision, if they love Him (175); all this should lead them to prayer, being that heartfelt longing after benefits, which they can reasonably expect or hope from God by virtue of divine perfections (177).

4. Conclusion

Using the observation of nature for theological and religious purposes is nothing new to mention only the opening verse of Psalm 19, "The heavens are declaring the glory of God". This type of approach was the central point of physico-theology that was very popular in Europe in the second half of the 17th and in the 18th century. Every part of nature could be used to that end, even the smallest elements of creation has traces of the creative work of God, and, in fact, the smaller the creation was the more amazing were these traces as the newly discovered microscope allowed then people to see. One such element was snow, on the one hand, a very common and thus unremarkable element, on the other hand, when investigated thoroughly, remarkable and mysterious with its common hexagonal shape. How can that be explained? Snow was investigated since the Presocratics and in the 17th and 18th centuries it became frequently a subject of both scholarly investigation and of religious reflection. Scholar made occasional theological remarks, clergymen used snow as one divine manifestation and they made scant references to scholarly results, but the most successful physico-theological approach was proposed late in that age, by Jan Edelman.

In Edelman's book, chiono-theology came to its own, as required by the spirit of physico-theology, which was quite aptly expressed by Leu-

twein: people should learn to recognize in visible creatures the invisible almighty God and climb to God on them like on a ladder allowing to be drawn to Him through His love[28]. The physical investigation of nature should lead people to the recognition of the Creator of this nature and of His attributes, which should lead them to follow the ethical rules, which, in turn, will have consequences in this life and the next.

OD NAUKI O ŚNIEGU DO TEOLOGII ŚNIEGU

Słowa kluczowe: śnieg, chiono-teologia, fizyko-teologia, chrześcijaństwo.

Streszczenie: Wynalezienie mikroskopu w XVII wieku było jednym z bodźców powodujących duże zainteresowanie śniegiem, jego pochodzeniem, miejscem w przyrodzie, a zwłaszcza formą płatków śniegu. W artykule przedstawiono badania naukowe z XVII i XVIII wieku oraz głębsze pochylenie się teologów nad śniegiem jako jednym z elementów przyrody, wskazujących na istnienie i atrybuty Boga oraz jako środek pozwalający na sformułowanie nauk wzbogacających życie duchowe. Chiono-teologia, czyli teologia śniegu, była bardzo popularną w tamtych czasach częścią fizyko-teologii, motywacją której było przekonanie, że badanie przyrody powinno prowadzić ludzi do uznania Stwórcy, a w konsekwencji do kierowania się w życiu Boskim kodeksem moralnym.

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