

VI. *An Account of a Book, intituled Christiani Ludov. Gersten Tentamina Systematis novi ad mutationes Barometri ex natura elateris aërei demonstrandas, cui adjecta sub finem, Dissertatio Roris decidui errorem antiquum & vulgarem per observationes & experimenta nova excutiens. Francofurti MDCCXXXIII, in 8^{vo}.*

I Shall not here give any Account of the various Hypotheses, which have been invented by the Learned, to solve the several *Phænomena* of the Barometer, and to explain the Changes of the Weather consequent upon the Rise and Fall of the Mercury, but refer my self to the ingenious Author of this Essay, who also proposes a new one, drawn from the Nature of the Elasticity of the Air, and delivered after the manner of the Geometricians.

The Essay itself consists of three Chapters; the first is wholly Mathematical, containing a new Theory concerning the Propagation of tremulous Vibrations along a Series of contiguous elastic Bodies. The second applies this Theory to the Solution of the chief Appearances of the Baroscope, and the last explains the several States or Constitutions of the Air and Weather connected with them.

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To give a clearer and fuller Apprehension of this Matter, our Author thinks it necessary to alter the common Definition of Elasticity, and use the following new Terms: The natural Equilibrium of an Elastic Body; its violent Equilibrium; and the Line of a tremulous Vibration.

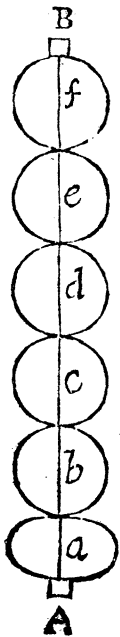
By the *natural Equilibrium* of an Elastic Body, Mr. *Gersten* means the external Figure and Extension, which an Elastic Body naturally has, when free from all external Pressure. By a *violent Equilibrium*, he understands that State or Degree of Expansion which an Elastic Body is kept in by some external compressing Force; and he calls that the *Line of a tremulous Vibration*, which a Point taken at Pleasure in an Elastic Body describes during the Vibration.

I pass over, for Brevity sake, the Corollaries drawn from his Definition of Elasticity concerning the Acceleration and Retardation of a Vibration, as also the Description and Use of an Instrument contrived to prove the Truth of what he had advanced; nor shall I take any particular Notice of *Prop.* III, IV, V, and VI, wherein he treats of the Velocity of the Elastic Bodies in their tremulous Vibration, of the Motion of stretched Strings, and their isochronal Vibrations.

In *Prop.* X he demonstrates, that supposing three Elastic Bodies to be detained in a *violent Equilibrium* in the same Line of tremulous Vibration, if the middle be farther compressed on all Sides, so as still to remain contiguous to the neighbouring Bodies, it may be restored, by tremulous Vibrations, to a greater Extension than it had before. He then
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shews the same to be true, supposing the elastic Body be placed between several other homogeneous elastic Bodies, in the State of a *violent Equilibrium*. For the Use and Application of all this, he refers us to the third Chapter.

The XI and XII *Propositions* deserve particular Regard: In the former he describes a *Machine*, by which any curious Person may enquire into the Phænomena and Laws of the Propagation of a tremulous Motion: In the latter he explains and demonstrates the Theory of those Propagations, found out by the Help of this Machine. The Substance of them is this.



Suppose a Series of elastic Globules or Rings, *a, b, c, &c.* in the Line of a *tremulous Vibration A B*, to be kept in a *violent Equilibrium*, an Obstacle being placed at *A* and *B*. Let us suppose also, the last Ring *a* to be compressed farther towards *A*, &c. so as that the Space left in the Line of Vibration may be taken up by the others.

These Things being supposed, the Author asserts, that by the Restitution of the compressed Ring *a*, the Force impressed will be propagated through the other Rings by an individual Action, *i. e.* the Ring *a* in restoring itself will first act only upon *b*, and compress it by the Difference of the Forces. Then *b* being compressed, will transfer the Force it receives, not backwards, but into the Ring

Ring *c*, by an individual Action, and compress it likewise in Proportion to the Difference of the Forces, and so on in the other Rings. So that the Compression of the last Ring or Body is to be look'd upon as it were like a Substance or Body put into Motion, which continues in Motion, 'till it meets with something else, that makes an equal or sufficient Resistance.

From the Whole Mr. *Gersten* draws this material Proposition, that the Body *a* may after this manner acquire, by repeated Vibrations, a greater Expansion in the Line *AB*, than it had before, provided the Series be long enough, so that the Force impressed may not be soon reflected. This Matter is treated of more at large in the following Propositions, to the end of the Chapter.

The *second Chapter* is an *Application* of the *Theory* deliver'd, to the Solution of the Phenomena of the Barometer, after the following manner. The Particles of Air, says Mr. *Gersten*, however unknown in other respects, are very well known to be capable of receiving and propagating tremulous Vibrations : From hence it follows, as also from some Principles of Sir *Isaac Newton*, that the Air (*as in Prop. V*) may be dilated by repeated tremulous Vibrations ; and by *Prop. VI*, these Vibrations may be generated or produced by a confused Motion of the Particles of the Air, or by the Agitation of a Wind.

The Author in *Prop. VII* and *VIII*, undertakes to demonstrate, that the Dilatation produced by the Motion of a Wind, is less when the ambient Air has a Motion the same Way, than if the Wind moved
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with the same sensible Velocity against the quiescent Atmosphere ; but that this Dilatation would be greater, if the Atmosphere had a Flux or Current in a Direction contrary to that of the Wind.

Mr. *Gersten* demonstrates in the next *Proposition*, that a perpetual *Easterly Wind* will reign in all Places within the Tropics, arising from the diurnal Heat ; and that this Wind will diffuse itself to the other Regions without the Tropics, and have a Direction declining from the East towards the North or South, according to the Situation of the Region on the terrestrial Globe ; that its Motion will be more remiss, the nearer the Places are to either Pole, and that the Angle of Declination from the East will be greater for the same Reason.

The preliminary Propositions being thus settled, he proceeds in *Prop. XIX*, to account for the rising and falling of the Mercury in the Barometer thus. The Air of the Atmosphere in our Regions has a natural Motion or Current, whose Direction is situated between the East and North Points of the Compass. If therefore a special Wind should spring up and blow in a contrary Direction, it will produce tremulous Vibrations, and consequently Dilatations of the Air ; then equal Bulks of the dilated Air dilated, will have a less Quantity of Matter than before : Therefore the Gravity of the Air will be lessen'd, and by Consequence the Quicksilver in the Weather-Glass will fall. And this Decrease of Gravity in the Air, and of the Height of the Mercury in the Baroscope, will be proportional to the Greatness of the Force of the Wind and Degree of Opposition of its Direction to that of the Flux of the Atmosphere conjointly.

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This, says Mr. *Gerſten*, is the Reason why the Mercury falls when Southerly or Westerly Winds blow, and why the Quickſilver ſinks ſo very low when theſe Winds blow Storm. On the contrary, ſince the Effect ceaſes when the Cauſe is removed, the Height of the Mercury will be greater, the fewer ſpecial Winds there are blowing in a contrary Direction. So that the gentle Winds that blow from the Points of the Compaſs which lie between the North and the Eaſt are, as the Author believes, nothing but the natural and univerſal Motion, Current or Flux of the Atmoſphere impeded by or meeting with very few ſpecial Fluxes. In order to illuſtrate and confirm the Truth of the Demonſtration of this Experiment, he hath in *Schol.* 1. quoted the Experiment of Mr. *Hauksbee*, in his *Phyſico-Mechanical Experi. Sect. V. Experi. 5, pag. 114. Edit. 2.*

The Deſign of *Prop. XX* is to prove, that a ſpecial Wind blowing parallel to the Direction of the univerſal, will permit the Mercury to ſtand at a greater Height, than if it had blown in a contrary Direction with the ſame Force. This he confirms by three Obſervations of his own in the *Scholium* annexed.

Propoſtion XXI ſhows why the Deſcents of the Quickſilver are ſucceſſive, and do uſually, as well as regularly, precede the Arrival of the Winds that cauſe them.

Propoſtion XXII aſſigns the Reason why very conſiderable Alterations in the Riſe or Fall of the Mercury are obſerved at the ſame time in different Places, though they are at a great Diſtance from each other.

In *Proposition XXIII*, he takes into Consideration what Influence the Heat has on the Variations of the *Baroscope*, and denies that it causes any sensible Changes: However, in the *second Scholium* of this Proposition, he explains by it, why the Limits of the Variations of the Mercury lessen, as the Places are nearer the *Tropics*.

The *third or last Chapter* is taken up in accounting for the various Changes of the Weather connected with, or consequent upon the Rise and Fall of the Mercury in the Weather-Glass. The ingenious Author beginning with the Original and Manner of forming Vapours, undertakes to settle and confirm, upon solid Principles, that which the learned and sagacious Dr. *Halley* had long ago communicated to the learned World, upon this Argument.

In *Proposition VI*, he makes use of the Principle mentioned before, concerning an elastic Body, that it restores itself to a greater Degree of Expansion than it was in before its tremulous Vibrations; and endeavours, from thence, to explain more particularly the Way, that Nature takes in forming and descending the Cavities of the vapoury Bubbles, and afterwards emitting or detaching them from the Surface of a Fluid.

Proposition VIII gives an Account of what will happen to Vapours, according to this Theory, when the surrounding Air is condensed, or rather compressed by an external Cause. Mr. *Gersten* affirms, that in this Case it is not possible for them to descend. In the *Scholium* subjoined, he enlarges upon this Subject, and maintains, that the same will happen if the

Air be condensed by any internal Cause, for Instance, Cold.

It was this *Proposition*, as the Author informs us, that put him upon enquiring more exactly into the Nature of Dews, which by their Fall in a cold or condensed Air seemed to contradict this Part of his Theory. The Result of his repeated and laboured Enquiries is a *Dissertation*, wherein he undertakes to prove by a Variety of Experiments, that Dews do not fall, as both the Vulgar and Learned believed before, but rise out of the Earth. Of this we shall give a brief Account, as soon as we have observed, that in *Propositions* IX and X, he considers what will happen to Vapours in any external Dilatation of the Air; and in *Proposition XI*, shows, that in that Case the Clouds are resolved into Rain; and upon this he deduces, from the two last Propositions, the Reason of the Descent of the Mercury in the Barometer in rainy Weather, and, on the contrary, of its Ascent in fine Weather.

The Design of the Dissertation annexed, is to enquire into the Nature of Dew, explain its Original and Kinds.

All Dews, according to our Author's Philosophy, owe their Original either to Vegetables or terrestrial ascending Exhalations. Such as derive their Origin from Vegetables, he takes to be only Exudations of their Leaves, &c. congealed by the Air. Before he enters upon the Proof of these Positions, he gives us three general Observations regarding the Circumstances that are requisite, in order to have a plentiful Dew

Dew in any Place. As first, the Place in the Day-time must be exposed to the Rays of the Sun for a considerable time; for in shady Places, or where the Sun shines but little, little or no Dew is to be found. There must also be a considerable Difference between the Heat of the Day, and the Cool of the Night; and in the last Place a sufficient Moisture in the Earth.

In treating of that Kind of Dew which is a Secretion or Exudation of a Juice in Vegetables, he observes, that some Plants furnish the Spectator with a very entertaining Sight, the little Drops of Dew being disposed after a very regular, not fortuitous Manner, upon the Surfaces or Edges of their Leaves. He gives us the Figures of some of them in a Plate.

To determine whether this beautiful Disposition of the dewy Particles is owing to a Descent from the chill'd Air over the Plant, or a Secretion made from the Juices of the Plant itself, he covered several with Glasses, or earthen Vessels, having their Mouths downwards; and yet the next Day plenty of this kind of Dew appeared in its usual regular Form.

As to the next Species, or common Dew, he produces so many, and so differently made Experiments, against the vulgar Opinion of its Descent that if they be all true, it seems difficult to support it against them. I shall mention some of the principal.

For two Months together, *viz.* *June* and *July* in 1728, every Night, several smooth Plates of Brass

were laid upon the bare Ground; and during these Experiments, he never observed the least Impressions or Traces of Dew on the upper Surfaces, whereas the lower were always covered with it. He repeated the same Experiments last Year, and with the same Success, excepting in one Case, where a Plate lying too near some *Lavender*, was bedewed a little on that Part of its upper Surface, which was next the Plant, the other Part however remaining dry. He also suspended these Plates by Threads, in an horizontal Situation, and found the Dew spread almost equally over both Surfaces, at the Height of three, four, or five Feet; at the Distance of one Foot and a half, the Lower was more bedewed; but at the Heights of one, two or three Inches, the lower was overspread with Dew, while the upper had none.

He is so impartial as to mention in *Section XVI*, some Experiments which he made, and at first View seem'd to contradict his Theory: For Instance, when he used convex Bodies, whether round or cylindrical, he found the upper Surface covered with Dew, and that, whether they were laid upon the Ground, or suspended at any Height from it.

This Observation is general, and extends to Bodies of this Kind, that are only contiguous, as Heaps of Straw, Hay or Wool. It is to Observations of this Kind, the vulgar Opinion of Dews falling, owes its Birth and main Support. Mr. *Gersten* therefore proposes to consider these distinctly in another Essay. But least any Argument should in the mean time be drawn from them against this Hypothesis of the Ascent of Dews from the Earth, he opposes Experiment to Experiment. Thus

Thus in *Section XVII*, he lays upon the Ground a Board two Foot and a half long, eleven Inches broad, and two Inches and a half thick, with a Quarter of a Sheet of Writing-Paper upon it, having about an Inch hanging over one Edge of it.

To secure the Paper from being removed out of its Place by the Wind, he fastens it with an Awl stuck perpendicularly, having a round wooden Handle, and lays a Knife with a cylindric wooden Handle, as an additional Weight. Upon his Return to see what Effect the Dew had upon them, he found that the small Part of the Paper which was extended over the Edge, was moistened with Dew, while the rest of the Paper, as also the upper Surface of the Board, were dry, but the upper Parts of the Handles of the Awl and Knife all wet.

An Experiment something a-kin to this was made with a Glass Tube laid horizontally upon a Brass Plate fourteen Inches square, having about two Inches and a half reaching beyond the Side of the Plate. The Tube was kept from rolling by two Parallelopipeds of Lead. The Event was, the whole Surface of the Tube was bedewed, while the upper Surface of the Plate remained dry.

In *Section XXI, XXII*, we have a Set of Experiments made with concave Vessels, having their Mouths upwards, and placed at different Elevations above the Earth. In these Cases also he found no Dew at the Bottom of their Cavities, nor on the Sides, except within about an Inch near the Brim.

Since Hoar-Frost is only common Dew congealed, he applied himself to make some of the same Kind of Experiments upon that, with Brass Plates laid upon
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the Ground as before. These likewise he found covered with this kind of Frost below, but free on the upper Superficies, agreeably to his Hypothesis.

The Author closes the Dissertation with a curious Inquiry into the Nature and Original of *Honey-Dew*. This he takes to be nothing but the Excrements of some Insects which are to be met with, adhering to the lower Superficies of the Leaves of Plants ; and appeals to the Evidence of Sense for a Demonstration.

Let any inquisitive Person, says he, lay a Piece of Paper under any of the Leaves abounding with these *Animalcula*, and in a small Space of Time, he will find a Liquor, or soft Substance, the very same with what we call *Ros Mellis*, gathered together in good Plenty upon it.

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