A Dissertation upon the Sacred Cubit of the Jews and the Cubits of the several Nations

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A DISSERTATION upon the *Sacred Cubit* of the *Jews* and the *Cubits* of the several Nations; in which, from the Dimensions of the greatest *Egyptian* Pyramid, as taken by Mr. *John Greaves*, the antient Cubit of *Memphis* is determined.
Translated from the* Latin *of Sir* Isaac Newton, *not yet published.

TO the description of the Temple belongs the knowledge of the *Sacred Cubit*; to the understanding of which, the knowledge of the Cubits of the different nations will be conducive.

The *Roman* and *Greek Cubits (a)*[1] were a Foot and a half, and, like the *Sacred Cubit*, consisted of six *Palms*, and twenty four *Digits*. For the *Roman* and *Greek* Feet contain'd four *Palms*, and sixteen *Digits*. The *Roman* Foot was likewise divided into <406> twelve *Unciæ* or *Pollices*, and was equal to $\frac{967}{1000}$ of the *English* Foot, as Mr. *Greaves*, who examined diligently the antient monuments in *Italy*, and consider'd the arguments of former writers, as *Philander*, *Agricola*, *Pætus*, *Villalpandus*, *Snellius* and others, has determined with the greatest accuracy of all other authors. The *Roman Cubit* is therefore $1\frac{4505}{10000}$ of the *English Foot*.

Of the *Greek Feet*, the *Attic* was most eminent. Modern writers represent it as equal to a *Roman* Foot and a *Semuncia* of that Foot; because the *Greek Stadium* consisted of six hundred *Greek Feet*; and a *Roman Milliare*, or Mile, of a thousand of the greater Roman Passus, or five thousand Feet; and antiently eight *Greek Stadia* were equal to a *Roman Milliare*. But it is probable, that the nearest round numbers were used here; and if we say, that the antients sometimes made the *Stadium* equal to an hundred and twenty-five *Passus*, that proportion might be deduced, not from a comparison of the Feet with one another, but from the foregoing proportion of the *Stadium* to the *Milliare*, express'd very near the truth in round numbers. This conjecture is confirm'd by reflecting, that *Polybius*, cited by *Strabo*, receded from this vulgar computation, and represented the *Milliare* as equal to 8 *Sta* <407> *dia*, and one third part; by which means the *Attic* Foot will be equal to the *Roman*. The former computation is favour'd by the *Ptolemaic* Foot, which is equal to a *Roman* Foot and a *Semuncia*, if the latter Foot was deriv'd from the *Attic*. The latter computation is countenanc'd by the Porphyry pillar dug up at *Rome*, with this inscription, ΠΟΔ. Θ that is, *nine Feet*; for the Foot of this pillar, as measured by *Philander*, exceeded the *Roman* foot only a ninth part of an *Uncia*. This difference shews the Foot not to be *Roman*, and the inscription proves it to be the *Greek* Foot. But whether it was the *Attic* Foot, let others determine. Till something more certain shall appear, we shall assume nothing, but that the *Attic* Foot was neither less than the *Roman*, nor greater than the *Roman* above a *Semuncia*. This being granted, we shall have the magnitude of the *Attic* Cubit to pretty great exactness.

The *Derah*, or *Arabian* Cubit (*b*)[2] consisted in like manner of six *Palms*, and 24 digits; and, in my opinion, was very near equal to the *Roman* or *Attic* Cubit. For it was a fifth part of the Royal Cubit of *Ægypt*; that is, as will immediately be <408> shewn, four simple Cubits of *Ægypt*, which are now equal to five *Roman* ones.

Three *Arabian* Miles were likewise equal to the *Persian Parasanga*, that is, to thirty *Attic Stadia*, and consisted of 1000 *Orgyiæ*, or *Arabian* Paces, that is, 4000 Cubits; by which means the *Arabian* Cubit will be equal to the *Attic*. For the wandering *Arabians* at first serving in war under the *Romans*, and afterwards founding an empire in *Syria*, learned from the conquered people the money, weights, and measures of the *Romans* and *Greeks*. We shall pass over this Cubit therefore, and proceed to those which are more antient.

From the Pyramids of *Ægypt* accurately measured by Mr. *John Greaves*, I collect the length of the antient *Cubit* of *Memphis* in this manner. The side of the first Pyramid was 693 *English* feet. It is very probable, that at first the measure of it was determined by some round number of *Ægyptian* Cubits. *Ibn Abd Alhokm*, quoted by Mr. *Greaves*, tells us, that the measure of each side was an 100 Royal Cubits of the antient times. But it is probable, that the *Ægyptians* learn'd, from the *Orgyiæ* of the *Greeks*, their measure of four Cubits of *Memphis*, and gave it the name of the *Royal Cubit*. Thus the side of the Pyramid will be 400 <409> simple Cubits, or four *Arourœ*; and the *Cubit* of *Memphis* will be equal to $1\frac{732}{1000}$ of the *English* Foot.

That the Pyramid was built by the Cubit of this magnitude, appears from several dimensions of it. The square passage leading into it of polished marble was in breadth and height $3\frac{463}{1000}$ of the *English* Foot, that is, two of the above-mentioned *Cubits* of *Memphis*. And of the same breadth and height were the four other galleries. In the middle of the Pyramid was a chamber most exquisitely form'd of polish'd marble, containing the monument of the king. The length of this chamber was $34\frac{38}{100}$ *English* Feet, and the breadth $17\frac{19}{100}$; that is, it was 20 Cubits long, and 10 Cubits broad, the Cubit being supposed to be $1\frac{719}{1000}$ of the *English* Foot. The difference between this measure and the former is $\frac{125}{10000}$, or one thirtieth of a Foot, that is, about one seventh of an Inch; an error of no importance, if we consider the much greater irregularities observ'd by Mr. *Greaves* in the best buildings of the *Romans*. The roof of this chamber consisted of nine oblong and parallel stones; the seven middle ones of which were of the same breadth, but the two outermost were less by half in breadth than the rest; and the breadth of them all <410> together was equal to the length of the chamber, or to 20 Cubits; so that the length of the middle stones was two Cubits and an half. The marble gallery, which led into this chamber, was 6 feet and 87 of 100 parts of a foot, that is, 4 Cubits of the chamber, in breadth. In the middle of this gallery was a way of polished marble, $3\frac{435}{1000}$ feet, that is, 2 Cubits broad; and on both sides the way were two banks, like benches, of polish'd marble likewise, $1\frac{717}{1000}$ feet broad, and $1\frac{717}{1000}$ feet deep; that is, in breadth and depth one Cubit. Who will therefore imagine, that so many dimensions not at all depending upon each other, should correspond by mere chance with the length of the Cubit assigned by us?

Besides, the division of this Cubit into 6 *Palms* is evident from the dimensions of the Pyramid. For the height of the gallery, according to Mr. *Greaves*, was about 26 Feet, that is, 15 Cubits. Subtract the height of the benches, and the remaining height will be 14 Cubits. This was divided into seven parts, according to the 7 ranges of the stones in the walls of the gallery; and every upper range projected over the lower about three inches, as is represented in the annexed figure; <411> where AB expresses the breadth of the way, ACD the bank or bench, DE the height of the first range of stone, EF the projection of the second range, and FG the height of it; GH the projection of the third range, and HI the height of it; and so on to the roof KL, which answers to the way AB. The height therefore of every range of stone was two Cubits; and the 6 projections EF, GH, &c. answering to one Cubit, were *Palmares*.

There are likewise, in the king's monument above-mentioned, specimens of the division of the Cubit. For since the Cubit DC is $1\frac{717}{1000}$ of a Foot, and consequently the *Palm* $\frac{286}{1000}$ of a Foot, ten *Palms* will be $2\frac{86}{100}$ Feet; seven *Palms* and three Digits will be $2\frac{717}{1000}$ Feet; and twenty five *Palms* and two Digits will be $7\frac{293}{1000}$ Feet.

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Now Mr. *Greaves* found the measure of the height of the monument within to be $2\frac{860}{1000}$ Feet, the breadth within to be $2\frac{218}{1000}$ Feet, and the length of the exterior superficies to be 7 Feet, 3 Inches and an half; that is, 7

$\frac{292}{1000}$ Feet. The height of the monument within was therefore 10 *Palms*, the breadth within 7 *Palms* and 3 Digits, and the length of the exterior superficies 25 *Palms* and 2 Digits, without any sensible error. The height and breadth of the exterior superficies was 3 Feet, 3 Inches and 3 quarters; that is, 11 *Palms* and 2 Digits and a quarter, if Mr. *Greaves* has been sufficiently exact in setting down the dimensions of it.

There are also other specimens of this Cubit; as particularly that the whole length of that gallery, with the hypothenuse of a rectangular triangle, whose base was 15 Feet, and height about 5 or 6, or perhaps 7 Feet, being measured by a cord, was 154 Feet. Subtract the hypothenuse, and there will remain the length of the gallery, 138 Feet; that is, 20 times the breadth, or 20 *Royal Cubits*. Two other galleries were likewise measured, and found to be in length 110 Feet, that is, sixteen *Royal Cubits*; and another Chamber was in breadth about 17 Feet, that is, 10 Cubits; and an *Anticameretta*, or *Anticloset*, was in length 7 Feet, in breadth about $3\frac{1}{2}$ Feet; that is, 4 Cubits long, and <413> about 2 Cubits broad. And it is my opinion, that the Pyramid was built throughout after the measure of this Cubit.

If any person shall hereafter exhibit in this manner the dimensions of the remains of the old buildings of the *Babylonians* and other nations, it will not be difficult to determine from thence the antient Cubits of those countries. In the mean time I shall produce one instance, which occurs, as a specimen of this calculation. Mr. *Purchas* (*c*)[3] informs us, that there is still extant between the antient *Babylon* and *Bagdad*, a vast rude structure of brick; the bricks of which his friend Mr. *Allen* found to be one Foot long, eight Inches broad, and six Inches thick; he means Inches of the *English* Foot. These proportions shew, that the bricks were regularly formed, and consequently, that in the making of them regard was had to some particular measure used by the *Babylonians*, which was of great use, to enable the workmen from the number of bricks to determine immediately the dimensions of the walls with respect to the length, breadth, and thickness, and *vice versa* to compute the number of the bricks necessary to the building of the wall agreed upon. As the *Babylonians* therefore measur'd their buildings by Cubits, it follows, that the bricks according to their length, breadth, and <414> thickness conjunctly must compose the measure of the Cubit. Now two bricks according to their length, three according to their breadth, and four according to their thickness, form the same measure; and consequently the measure is that of a Cubit. A *Babylonian* Cubit is therefore equal to two *English* Feet; and the component parts intimate the division of this Cubit into six *Palms*, so that the dimensions of the bricks may be express'd in round numbers of Palms; the length by 3 *Palms*, the breadth by 2, and the thickness by 1 $\frac{1}{2}$. This Cubit may perhaps be determined hereafter with more exactness by a greater variety of observations.

The magnitude of the *Persian Cubit*, I think, may be determin'd from their *Parasanga*. For it is to be considered, that the greater measures, which exceeded the human members, us'd to be deduced from the lesser by multiplication, in which multiplication the *denary* and sometimes the *binary* numbers were employ'd. Thus the *Roman* (*d*)[4] *Calamus* or *Pertica* consisted of ten Feet; the *Scrupulum* of ten Feet in length, and ten in breadth; the *Versus* of an hundred Feet in length, and an hundred in breadth; the *Clima* (a measure deriv'd from the *Greeks*, as the name shews) of ten *Orgyiæ* in length, and <415> ten in breadth; the *Actus* of two *Climata* in length, and two in breadth; the *Jugerum* of two square *Actus* in length, and ten in breadth; the *Centuria* of ten *Decumani* in length, and ten in breadth, within Italy; but without, of twice that number; the *Saltus* of an hundred *Decumani* in length, and an hundred in breadth; the *Milliare*, or Mile, of a thousand *Passus* in length; and the *Iter Diei*, or *Day's Journey*, of twice ten *Milliaria*. The *Greek* Reed, call'd Ἄκαινα, consisted of ten Feet; the *Clima* of ten Feet in length, and ten in breadth; the *Plethrum* of an hundred Feet in length and breadth; the *Stadium* of an hundred *Orgyiæ* in length; and the *Iter Diei*, according to *Herodotus*, of two hundred *Stadia*. And in the province of *Cyrene*, in the lands which *Ptolemy* a *Greek* king of *Ægypt* left to the *Roman* people, the (*e*)[5] *Plinthides* consisted of fifty *Limites* in length, and fifty in breadth; and each side of those square *Limites* were ten *Stadia*.

It appears also from several instances, that as the western nations proceeded from the Foot multiplied by ten, so the eastern did from the Cubit multiplied in the same manner. Thus among the *Jews*, a nation us'd to the feeding of cattle, the *Kibrath Terræ*, <416> or pasture-land, sufficient, I think, for a flock under one shepherd, was determined by the space of a thousand Cubits, and a Sabbath-day's Journey by that of two thousand Cubits. And thus among the *Ægyptians*, the *Aroura* consisted of an hundred Cubits in length, and an hundred in breadth. And because the *Ægyptians* every year after the inundation of the *Nile* divided their lands into *Arourœ*, the Reed ought, for the greater expedition in measuring, to consist of ten Cubits, that by the

repetition of ten they might make an *Aroura*. And for the like reason the greater measures, into which those lands were divided, ought to consist of tens and hundreds of *Arourœ*.

The greater measures therefore of the antient nations consisted of the round numbers of those lesser measures from which they were derived; and consequently the *Schœni* of the *Ægyptians* and the other eastern nations, and the *Parasangœ* of the *Persians*, consisted of round numbers of Cubits. Now the least *Schœnus* of the *Ægyptians*, by the testimony of *Artemidorus* and *Strabo*, was equal to thirty *Greek Stadia*; and the *Parasanga*, by the testimony of *Herodotus*, *Xenophon*, *Hesychius*, *Suidas*, *Agathias*, and others cited by *Strabo*, was likewise equal to thirty *Stadia*; and the round number of Cubits, to <417> which so many *Stadia* were equal, are ten thousand. That *Schœnus* therefore consisted of 10000 *Cubits* of *Memphis*, and the *Parasanga* of as many *Persian* Cubits; and 10000 of the Cubits of both kinds were equal to 30 *Stadia*.

The Calculation of the *Ægyptian* Cubit is confirmed by the present Cubit of the *Ægyptians* used in the city of *Grand Cairo*, which Mr. *Greaves* found to be $1\frac{824}{1000}$ of the *English* Foot. This Cubit approaches nearer to the antient Cubit of *Memphis*, than to the lesser Cubits of the *Greeks*, *Romans*, and *Arabians* who reigned in *Ægypt*; and therefore it seems to be derived from that of *Memphis*. But it is greater than that. And what wonder is it, that a measure should be somewhat increased in the space of above 3000 years? The measures of Feet and Cubits now far exceed the proportion of human members; and yet Mr. *Greaves* shews from the *Ægyptian* monuments, that the human stature was the same above 3000 years ago, as it is now. The measures therefore are increased, the reasons of which may be assigned. The instruments, which use to be preserved as standards of measures, by contracting rust are increased. Iron beaten by the hammer may insensibly relax in a long space of time. Artificers likewise in making <418> instruments, choose to err in the excess of the materials; and when by filing they attain any measure, which they think sufficient, they stop, knowing that they can soon correct that little excess by filing, if their master should complain of it; but that they cannot remedy a defect. Let us suppose therefore, that all measures have increased by degrees, especially in the first ages, when less care was taken of them; and the Cubit of *Memphis*, about the time of the *Roman* Empire, will be a mean between the antient and the modern Cubit, but will approach nearer to the modern. The antient Cubit was $1\frac{719}{1000}$ of the *English* Foot, and the modern is $1\frac{824}{1000}$ of the *English* Foot. The mean therefore between them will be about $1\frac{78}{100}$, or $1\frac{79}{100}$ of a Foot. Now 10000 of such mean or middle Cubits make, as they ought, about 30 *Attic Stadia*.

The former calculation of the *Persian* Cubit is confirmed by the *Arish*, or modern *Persian* Cubit, which (being doubled, as I suppose) Mr. *Greaves* found by measuring to be $3\frac{197}{1000}$ of the *English* foot. If half of this was the simple Cubit, and it increased from the time of the *Greek* and *Roman* Empire after the manner of the Cubit of *Memphis*, it must antiently have been about $1\frac{57}{100}$ of the *English* Foot. *Herodotus* stiles this Cubit, <419> compared with the Cubits of the *Greeks* and neighbouring nations, the *middling Cubit*; and tells us, that the royal *Persian* Cubit was larger than it by 3 Digits. If we understand by them, Digits of the middling Cubit, which was more known to the *Greeks*, the royal Cubit will be to the middling Cubit as 27 to 24; and since the middling Cubit is $1\frac{57}{100}$ of the *English* Foot, the royal Cubit will be about $1\frac{676\frac{1}{4}}{1000}$. Now 10000 of such Cubits make, as they ought, about 30 *Attic Stadia*.

The preceding computations are likewise confirm'd by a certain general reason, by comparing the Feet and Cubits used at first in every nation according to the proportion of the members of a man, from which they were taken. For the Foot of a man is to the *Cubit* or lower part of the Arm of the same man as about 5 to 9, as I my self have measur'd, and any person may easily find by his own body. And the oldest Feet, of which any account has been transmitted to us, are the *Roman*, the *Ptolemaic*, and the *Drusian* Foot at *Tongeren* in *Germany*, the last of which is equal to $13\frac{1}{2}$ *Unciæ* of the *Roman* Foot. And to these three Feet, according to the proportion of 5 to 9 answer the three Cubits, $1\frac{7406}{10000}$ of the *English* Foot, $1\frac{8056}{10000}$ of the *English* Foot, and $1\frac{9582}{10000}$ of the *English* Foot; and of about <420> these magnitudes are the antient Cubits determined by us above, *viz*. those of *Memphis*, *Babylon*, and *Persia*; to which add that of *Samos*, which *Herodotus* represents as equal to the Cubit of *Memphis*. The *Greek* and *Roman* Cubits, which were secondary measures, adapted to the measures of the Feet before received, ought not to come under consideration here.

The Cubits of the Eastern Nations, with which the *Jews* were surrounded, being determined in this manner, we may from hence form a conjecture concerning the magnitude of the *Jewish* Cubit. The vulgar *Jewish* Cubit ought not to be greater than them all, nor the sacred Cubit less than them all. The opinion of *Villalpandus* and others therefore is to be rejected, who represent the vulgar Cubit as equal to two *Roman* Feet and an half; and I think them likewise mistaken, who make the sacred Cubit and *Attic* Cubit equal. That the sacred Cubit was very large, appears from the *Jewish Calamus* or Reed, which contained but six of these Cubits; and from the antiquity of this Cubit, since *Noah* measured the Ark with it. However, it is not to be magnified in such a manner, that the vulgar Cubit (which in the time of *Moses* was called the *Cubit of a man*, *Deut*. iii.II.) <421> should much exceed the Cubit of a tall man. But we shall circumscribe these Cubits in narrower limits in the following manner.

We learn from the *Talmudists* and *Josephus*, that the *Jews* used the measure of four sacred *Palms* instead of the *Greek* Cubit. The *Greek* Cubit therefore approached nearer to 4 *Jewish Palms* than to 5 or 3; that is, it was less than $4\frac{1}{2}$ *Palms*, and greater than $3\frac{1}{2}$. Hence it follows, that the sacred Cubit of 6 Palms was less than $2\frac{4}{7}$ *Attic* Feet, and greater than 2 *Attic* Feet.

The stature of the human body, according to the *Talmudists (f)*[6], contains about 3 Cubits from the feet to the head; and if the feet be raised, and the arms be lifted up, it will add one Cubit more, and contain 4 Cubits. Now the ordinary stature of men, when they are bare-foot, is greater than 5 *Roman* Feet, and less than 6 *Roman* Feet, and may be best fix'd at 5 Feet and an half. Take the third part of this, and the vulgar Cubit will be more than 20 *Unciæ*, and less than 24 *Unciæ* of the *Roman* Foot; and consequently the sacred Cubit will be more than 24 *Unciæ*, and less than $28\frac{4}{5}$ *Unciæ* of the same Foot.

Josephus writes, that the Pillars of the great court were as large as could be em <422> braced by three men with their arms join'd. The *Orgyia* or Fathom of a man is commonly supposed equal to the stature of the same man, but in reality exceeds it about one Palm of the *Roman* Foot. The common people use the nearest round numbers; in this case the true numbers are to be employed; add therefore a Palm to the measures of the stature of a man above express'd, and the sum being tripled, $15\frac{3}{4}$ *Roman* Feet will be greater, and $18\frac{3}{4}$ less than the circumference of the pillar.

Now that circumference, according to the *Talmudists* and *Josephus*, was, as above, 8 Cubits, at least in the inner court. Taking therefore about an eighth part of the preceding numbers, the sacred Cubit will be greater than two *Roman* Feet, and less than two and a third. We have taken here the pillars of both courts, that is, in thickness, tho' not in height. It is certain, that the pillars of the inner court were not thicker than those of the outer court; and therefore the latter computation must necessarily be admitted.

A Sabbath-day's journey, by the unanimous consent of the *Talmudists* and all the *Jews*, was two thousand Cubits. Hence the *Chaldee* interpreter upon *Ruth* i.6. says, "We are commanded to observe the Sabbath and good days, so as not to go above <423> two thousand Cubits." The Jews describing this journey, instead of Cubits, sometimes substitute Paces. *Erasmus*, in his notes upon *Acts* i.12. writes thus concerning the Sabbath-day's Journey: *The Evangelist means the space of two thousand Paces. It was not lawful for the Jews to travel farther on the Sabbath-day. This is asserted by St.* Jerome, *writing to* Algasia, *in his tenth question*, viz. *that the* Jews *religiously observed not to walk on the Sabbath-day above two thousand Paces, agreeably to the appointment of* Akiba, Simeon *[the Just] and* Hillel, *Rabbins, whom they use to call our masters*. Thus writes *Erasmus*, who reads *passus* in St. *Jerome*, and not *pedes*, as it is corruptly in the printed editions of that father. And hence in *Numb*. xxxv.4. instead of *a thousand Cubits*, the Latin interpreter substitutes *a thousand Paces*. But we must take care not to understand by them the *Roman* or *Greek* Paces; for in *Sebbolch Lecheth*, *Tract*. 22. *cap. de Sabbat*. those Paces are thus described: Samuel *travell'd thro' the valley, and knew not the limit of the Sabbath. A Sabbath-day's journey is two thousand middling Paces*. As if he had said, a Sabbath-day's journey is a journey of two thousand paces of a man travelling upon a sabbath, not with speed, as in the *Roman* Paces, nor too slowly, but <424> moderately, in the manner of those who travel on the sabbath-day. Now men of a middling stature, in walking in this manner, go every step more than two *Roman* Feet, and less than two and a third. And within these limits was the sacred Cubit circumscribed.

The *Talmudists* write, that the height of the steps, by which they ascended to the inner court, was half a Cubit, and their retractions half a Cubit. They mean the sacred Cubit; and we see that *Josephus*'s computation, with

regard to the height of these steps, corresponds with them. Now *Vitruvius* determines, that the height of steps ought not to be more than 10 *Roman Unciæ*, and the retractions not less than 18 *Unciæ*; when, since the *Jews* make the height equal to the retractions, we must suppose that they took a middle proportion, and that the height, as well as the retractions, made about 12, or at most 13 *Roman Unciæ*. The middle proportion between 10 and 18 is about $13\frac{5}{12}$. And I should be inclined to maintain, that this height was not at all exceeded, lest it might have been difficult to ascend the steps. The sacred Cubit therefore was less than 27 *Roman Unciæ*, but not less than 24 *Unciæ*, in order that the retractions of the steps might not be too much lessen'd.

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The Cubit being thus circumscribed within certain limits, and the erroneous opinions of other writers being thus refuted, we may now assign the more exact measure of it with greater assurance; and this we shall do by the following argument.

It is agreeable to reason to suppose, that the *Jews*, when they passed out of *Chaldea*, carried with them into *Syria* the Cubit which they had received from their ancestors. This is confirmed both by the dimensions of *Noah*'s ark preserv'd by tradition in this Cubit, and by the agreement of this Cubit with the two Cubits, which the *Talmudists* say were engrav'd on the sides of the city *Susan* during the empire of the *Persians*, and that one of them exceeded the sacred Cubit half a Digit, the other a whole Digit. *Susan* was a city of *Babylon*, and consequently these Cubits were *Chaldaic*. We may conceive one of them to be the Cubit of the royal city *Susan*, the other that of the city of *Babylon*. The sacred Cubit therefore agreed with the Cubits of divers provinces of *Babylon* as far as they agreed with each other; and the difference was so small, that all of them might be derived in different countries from the same primitive Cubit, the *Jewish* Cubit being less inlarged after sacred things began to be determined by it. This <426> therefore was the proper and principal Cubit of the *Jews*. But that people afterwards going down into *Ægypt*, and living for above two hundred years under the dominion of the *Ægyptians*, and enduring an hard service under them, especially in building, where the measures came daily under consideration; they must necessarily learn the *Ægyptian* cubit. Hence came the double Cubit of the *Jews*, viz. that of their own country, and the adventitious one, which, from its being used upon ordinary occasions only, was esteemed vulgar and profane. This hypothesis is confirmed by the proportion of the Cubits to each other. For the *Babylonian* Cubit of two *English* Feet is to the Cubit of *Memphis* of $1\frac{719}{1000}$ of the *English* Foot, as 6 to $5\frac{157}{1000}$, that is, as the sacred Cubit to the vulgar Cubit very near. The small fraction of $\frac{157}{1000}$ might arise from either the difference of the *Babylonian* Cubits, or the greater antiquity of the *Babylonian* building, than of the pyramid, or the dimension of the brick, expressed not in the exact, but the nearest round numbers.

Suppose the thickness of the brick to be $6\frac{3}{16}$ *English* inches, the breadth $8\frac{1}{4}$ inches, and the length $12\frac{3}{8}$ inches; and a Cubit double that length will be to the Cubit of *Memphis* as 6 to 5. I am inclined therefore <427> to think, that the Cubit of *Memphis*, at the time when the *Jews* went down into *Ægypt*, was equal to 5 *Palms* of the *Chaldæo-Hebraic* Cubit; and that the *Jews* thus determining the magnitude of that Cubit by five *Palms* of the proper Cubit, the *Palms* of *Memphis* became at last neglected, and the double Cubit, with only a simple *Palm*, remained among the *Jews*. Besides, as it is reasonable to suppose, that the profane and adventitious Cubit agreed with the Cubits of the nations round about, viz. those of *Memphis*, *Samos*, and *Persia*; so it appears from the following argument, that this Cubit was the same with that of *Memphis*. The different measures of the Cubit of *Memphis*, taken from different parts of the Pyramid, were $1\frac{727}{1000}$, $1\frac{719}{1000}$, and $1\frac{732}{1000}$ of the *English* Foot. To these measures in the proportion of the sacred Cubit to the vulgar *Jewish* Cubit are the measures $2\frac{604}{10000}$, $2\frac{628}{10000}$, and $2\frac{784}{10000}$ of the *English* Foot, which in *Unciæ* of the *Roman* Foot are $25\frac{57}{100}$, $25\frac{60}{100}$, and $25\frac{79}{100}$, and consequently fall in the middle of those limits, with which we have before circumscribed the sacred Cubit, and which were 24 and 27 *Unciæ* of the *Roman* Foot. Thus therefore, by means of these limits, those measures agree with the sacred Cubit, and consequently the measures of the Cubit of <428> *Memphis* agree with the vulgar Cubit. Supposing therefore that the *Jews* learned the Cubit of *Memphis* in *Ægypt*, and that it was their vulgar Cubit, and consequently that in the time of *Moses*, and soon after, when, as Mr. *Greaves* contend, the Pyramids were built, the vulgar Cubit was of the same magnitude with that of *Memphis*; the sacred Cubit in those times was not less than $25\frac{57}{100}$, nor greater than $25\frac{79}{100}$ *Unciæ* of the *Roman* foot. Those, who shall hereafter examine the Pyramid, by measuring and comparing together

with great accuracy more dimensions of the stones in it, will be able to determine with greater exactness the true measure of the Cubit of *Memphis*, and from thence likewise of the sacred Cubit. In the mean time for the precise determination of the Cubit of *Memphis*, I should choose to pitch upon the length of the chamber in the middle of the Pyramid, where the king's monument stood, being very large, and built with admirable skill; which length was the twentieth part of the length of the whole Pyramid, and contained 20 Cubits, and which was very carefully measured by Mr. *Greaves*, as he informs us himself. And from hence I would infer, that the sacred Cubit of *Moses* was equal to 25 *Unciæ* of the *Roman* Foot, and $\frac{6}{20}$ of an *Uncia*; or, <429> what is equivalent that it had the same proportion to two *Roman* Feet as 16 to 15.

Mersennus in his treatise *de Mensuris*, *Prop*. I. *Cor*. 4. Writes thus: *I find that the Cubit, (upon which a learned* Jewish *writer, which I received by the favour of the illustrious* Hugenius, *Knight of the order of St. Michael, supposes the dimensions of the temple were formed,) answers to* $23\frac{1}{4}$ *of our inches, so that it wants* $\frac{3}{4}$ *of an inch of two of our Feet, and contains two* Roman *Feet, and two Digits and a Grain, which is* $\frac{1}{4}$ *of a Digit*. The *Paris* Foot, with which *Mersennus* compared this Cubit, is equal to $1\frac{68}{1000}$ of the *English* Foot, according to Mr. *Greaves*; and consequently is to the *Roman* Foot as 1068 to 967. In the same proportion reciprocally are $23\frac{1}{4}$ and $25\frac{68}{100}$. That Cubit therefore is equal to $25\frac{68}{100}$ *Unciæ* of the Roman Foot, and consequently falls within the middle of the limits $25\frac{57}{100}$ and $25\frac{79}{100}$, with which we have just circumscribed the sacred Cubit; so that I suspect this Cubit was taken from some authentic model preserved in a secret manner from the knowledge of the Christians. Lest any person should be surprized, that the Cubit, which we have concluded to have been in the time of *Moses* $25\frac{60}{100}$ inches, should not have increased more in three thousand years; he may observe, that the *Palms* <430> used in building at *Rome*, which was antiently 9 *Unciæ* of the *Roman* Foot, is now equal to $\frac{732}{1000}$ parts of the *English* Foot, that is, $9\frac{1}{12}$ *Unciæ*, and consequently that in fifteen hundred years it has increased but $\frac{1}{12}$ of an *Uncia*, though it was not preserved in a religious manner.

Some compute the Cubit from *Solomon*'s brazen sea. Lest any objection should be raised from thence, I shall briefly remark, that the bottom of that sea ought not to be represented spherical, as it generally is, but flat, in such a manner that all the water might run out for the use of the priests, and the vessel might stand commodiously upon the backs of the oxen, and the oxen not hinder the priests from coming to the cocks. However I would not represent it under a cylindrical figure. The following one will be more beautiful. Let the line AB, of ten Cubits, be bisected in C; and taking upon it AD, EB, of a Cubit each, erect the perpendiculars DF, CG, EH, each of them of five Cubits, and with the semiaxes AD, DF, and BE, EH, describe the quadrants of the <431> ellipses AF, BH, and drawing the right line FH, the figure AFGHB convolved round the axis CG, will describe the external superficies of the vessel, whose cavity, if it be an hand-breadth thick, will contain about thousand baths, supposing that a bath was equal to twelve *Roman Congii* (as *Agricola* and others maintain) and that seven *Congii* and an half will fill a Cubic *Roman* Foot, as Mr. *Greaves* found by the *Farnesian Congius*. It is said likewise, that this sea contained three thousand baths; whence some affirm, that there were two kinds of baths. Others understand a dry measure, whose *Cumulus* equaled half the contents; others suspect a various reading; others imagine, that the sea contained two thousand baths for daily use, but, when full, could receive three thousand baths. I shall not attempt to determine the dispute.

This is what I thought proper to lay down at present with regard to the magnitude of this Cubit. Hereafter perhaps those, who shall view the sacred mount, and the monuments of the *Chaldeans*, by taking accurately the various dimensions of the stones, bricks, foundations, and walls, and comparing them together, will discover something more certain and exact.

The *Roman* Cubit therefore consists of 18 *Unciæ*, and the sacred Cubit of $25\frac{3}{5}$ *Unciæ* of the *Roman* Foot; and consequently those Cubits are to each other in round numbers as 2 to 3 very near. And this proportion is used by *Josephus*, out of regard to the greater expedition in computing the bulk of the buildings. For writing to the *Romans* (*g*)[7], he every where puts three *Roman* Cubits for about two sacred Cubits, except in some of the most eminent dimensions of the temple, properly so called, and set down in scripture, in which case he

thought proper to retain the sacred Cubit. This will appear by comparing the Cubits of *Josephus* with the sacred Cubits of the *Talmudists*, in the following table.

		Josephus's Cubits.	Sacred Cubit.	*Talmud* Cubits.	*Vulgar* Cubits.
The height of the wall *Chajil*	without	40	$26\frac{2}{3}$		
	within	25	$16\frac{2}{3}$		
Difference answering to the 19 steps		15	10		
Height of those 19 steps		15	10	$9\frac{1}{2}$	
Height of the *Septum cancellatum*		3	2		2
Height	of the gates	30	20	20	
Breadth		15	10	10	
Height of the altar		15	10	10	
Breadth of the altar		50	$33\frac{1}{2}$	32	
Height of the temple within		60	40	40	
Circumference of the pillars		12	8	8	

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Thus likewise, where *Josephus* in a round number makes the *Exhedras* thirty Cubits, we must write twenty sacred Cubits, or more exactly twenty two; and the like reduction is necessary in all the other numbers of *Josephus*.

[1] *(a)* Vitruvius lib. 3. Hero in Isagoge. Hesychius. Suidas in vocibus ωλέθρον & ωους. Columella lib. 5. de Re Rusticâ, qui cubitum nominat *semipedem*, quasi *pedis* & *semis*. Vid. & Frontin. de Limit. Agrorum; & Isidor. Hispalensem, lib. 15. c. 15. Authors are agreed upon these Cubits, amongst whom *Agricola* and Mr. *Greaves* are especially to be consulted.

[2] *(b) Abulfedæ* Geograph. Arab. and *Muhammed Ibn Mesoud*, quoted by Mr. *Greaves*.

[3] *(c)* Pilgrimage, par. I. lib. I. c. II.

[4] *(d)* Vide Hygin. de Limitib. constituend. & Siculum Flaccum de Condit. Agrorum.

[5] *(e)* Hygin. de Limit. constit.

[6] *(f)* This proportion is expressly set down in *Mishnaioth*, Tract. de *Ghaburim*, cap. 4. ה in Comment.

[7] Josephus in Prologo Belli Judaici.