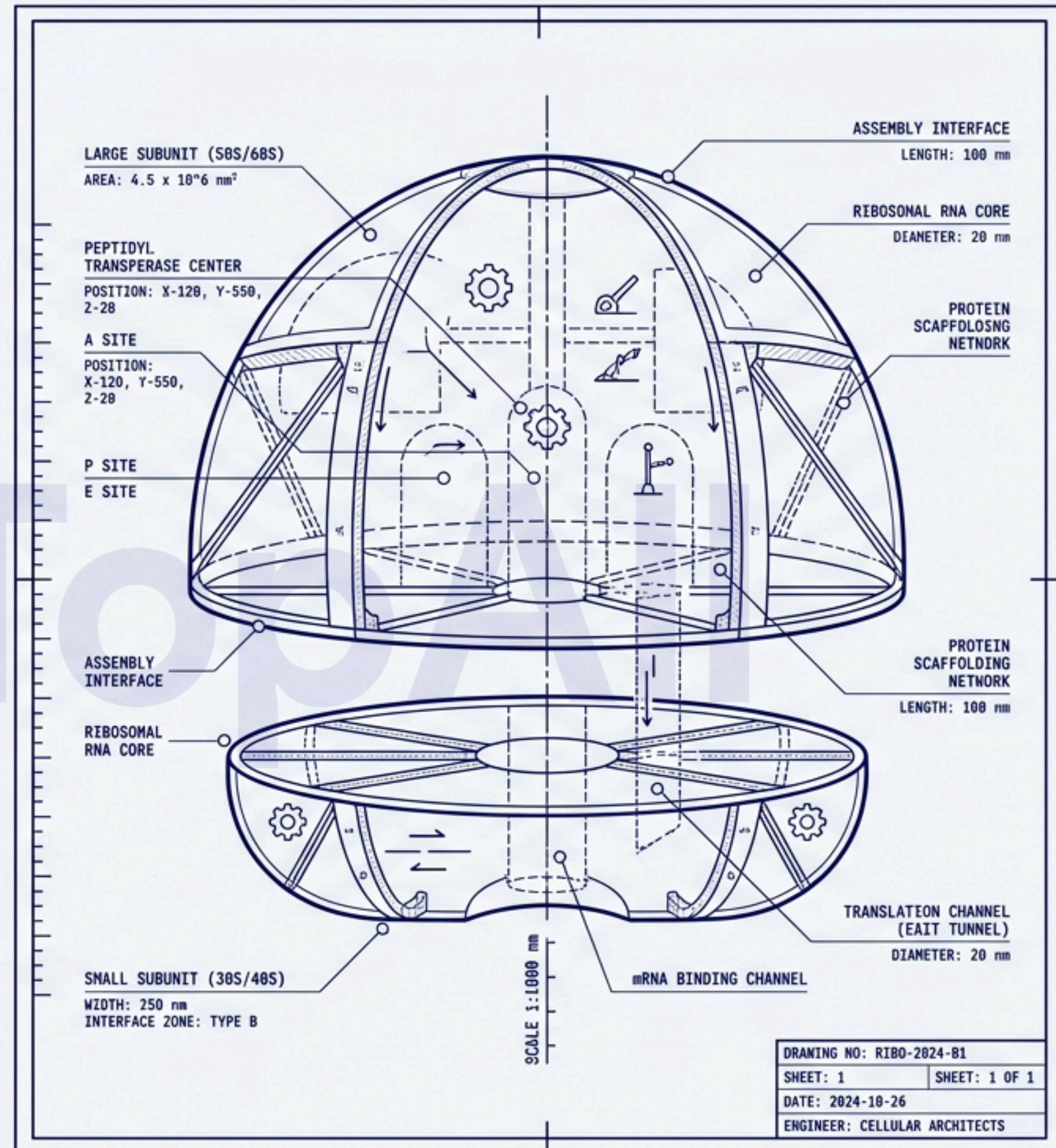


Protein Factories of the Cell

The structural and functional blueprint of the Ribosome.



The Ultimate Non-Membrane Organelle



RNA and Protein Composition

Ribosomes are highly dense, granular structures built entirely from Ribonucleic acid (rRNA) and specialized proteins. Size ranges roughly 15 nm by 20 nm.

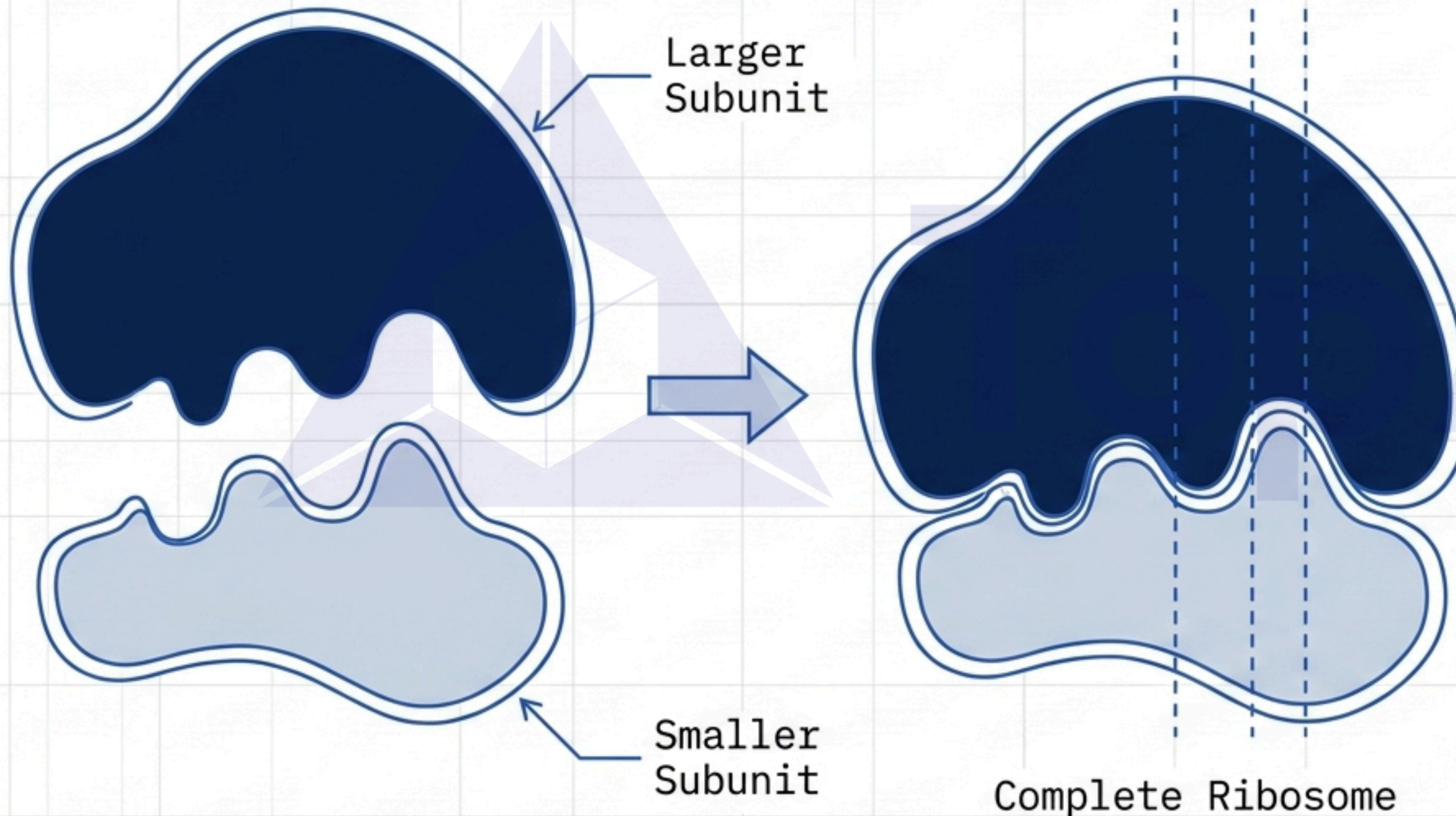
Discovery: First observed as dense particles under the electron microscope by George Palade in 1953.

No Surrounding Membrane

Unlike mitochondria or the nucleus, ribosomes entirely lack a lipid bilayer. This structural freedom allows them to operate in diverse cellular environments.

Because they lack a membrane, ribosomes are the universal organelles—found across all domains of life, in both eukaryotic and prokaryotic cells.

Two-Part Assembly



Every functional ribosome, regardless of the organism, requires the docking of these two distinct subunits to translate mRNA into proteins.



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The Measurement Standard: 'S'

THE SVEDBERG UNIT

Ribosomes are categorized by their sedimentation rate in an ultracentrifuge—indirectly measuring their physical profile rather than just their molecular weight.



[S] = Sedimentation Coefficient

[S] $\propto$ (Density $\times$ Size)



The S-Math Paradox. Svedberg units are not strictly additive. When two subunits combine, they lose surface area and become more aerodynamic, meaning they sediment slower than the direct mathematical sum of their individual rates.

The 70S Ribosome

The Prokaryotic Standard

$$\begin{array}{rcl} & [50S] & \text{Larger Subunit} \\ + & [30S] & \text{Smaller Subunit} \\ \hline = & [70S] & \text{Complete Ribosome} \end{array}$$

Prokaryotic Cytoplasm
(Associated with plasma
membrane or free-floating)

Chloroplasts
(Inside the stroma of
plant cells)

Mitochondria
(Inside the mitochondrial
matrix)

The 80S Ribosome

The Eukaryotic Standard

$$\begin{array}{rcl} & [60S] & \text{Larger Subunit} \\ + & [40S] & \text{Smaller Subunit} \\ \hline = & [80S] & \text{Complete Ribosome} \end{array}$$

Eukaryotic Cytoplasm
(Free-floating in the matrix)

Rough ER
(Attached to the outer surface of the
Endoplasmic Reticulum)

Ribosome Specifications

Feature	70S Ribosome	80S Ribosome
Primary Domain	Prokaryotes	Eukaryotes
Larger Subunit	50S	60S
Smaller Subunit	30S	40S
Known Locations	Cytoplasm, Mitochondria, Chloroplasts	Cytoplasm, Rough ER

The Ultimate Function: Whether 70S or 80S, several ribosomes often attach to a single mRNA strand to form a **polyribosome (polysome)**. Together, they translate genetic code into the proteins that sustain all life.



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