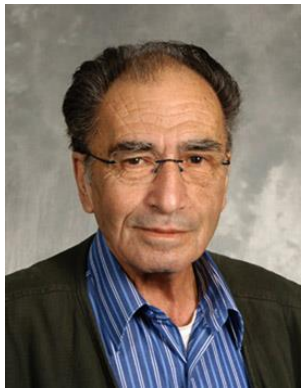
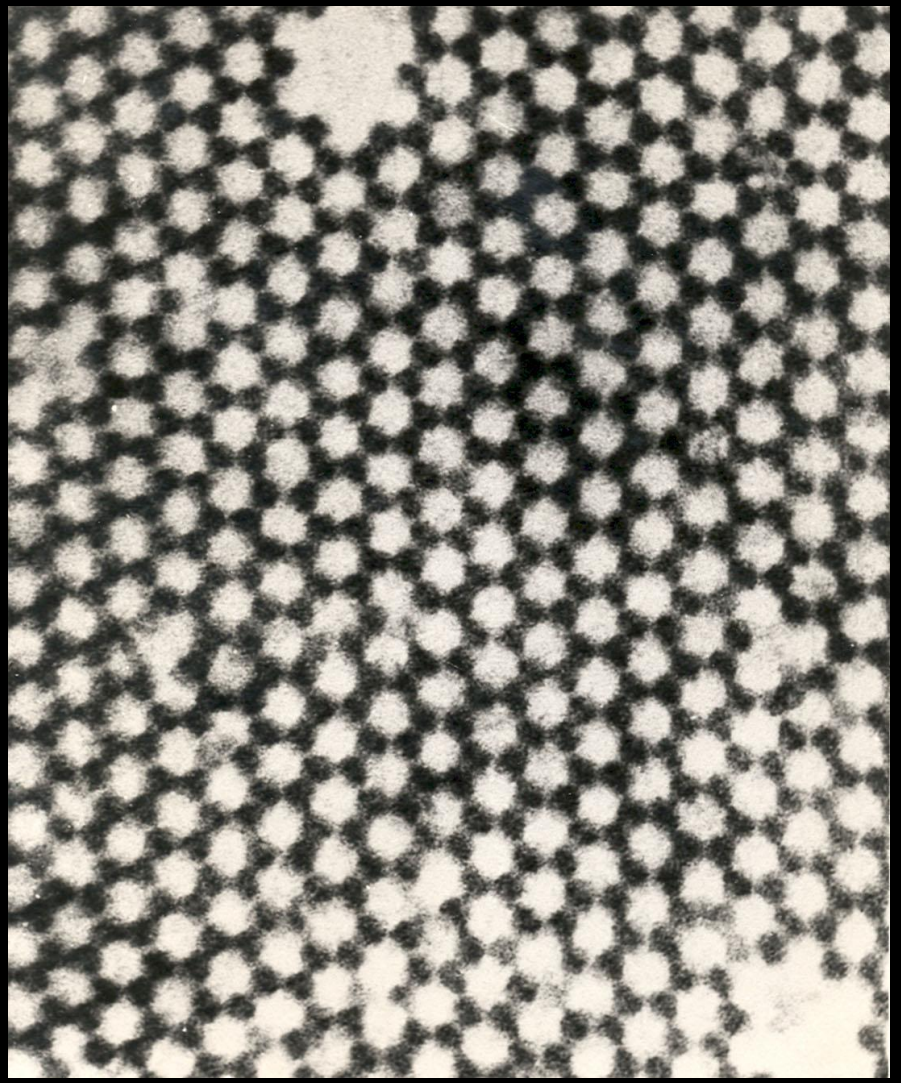
TALMON ARAD & the RIBOSOMES



I first met Talmon during my army service, at the Head quarters of the Chief Medical Officer.

A decade later I met him again, as the top electron microscopes in Kevin Leonard' lab at EMBL, Heidelberg.

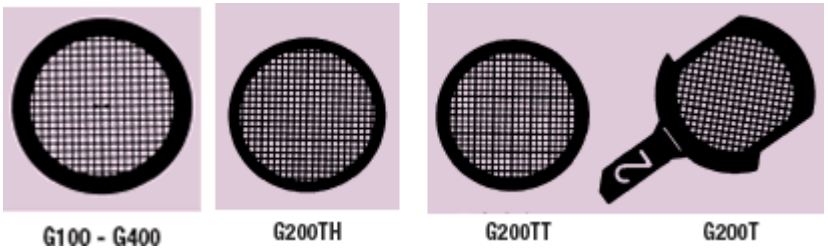
This way he entered the ribosome field.

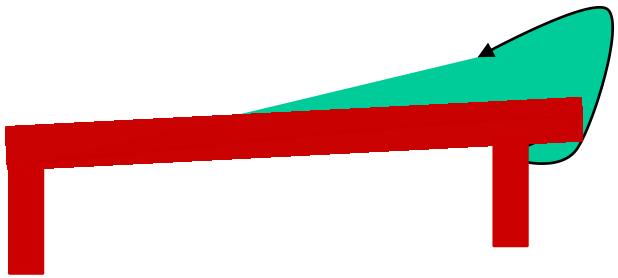


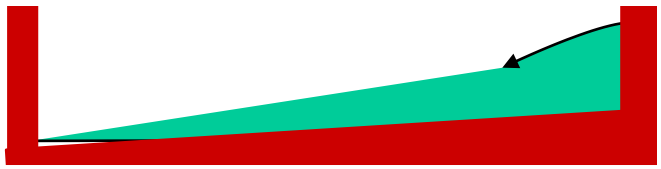
Work done at EMBL

The upside-down "miracle" 1986

Talmon Arad & Ute Piefke







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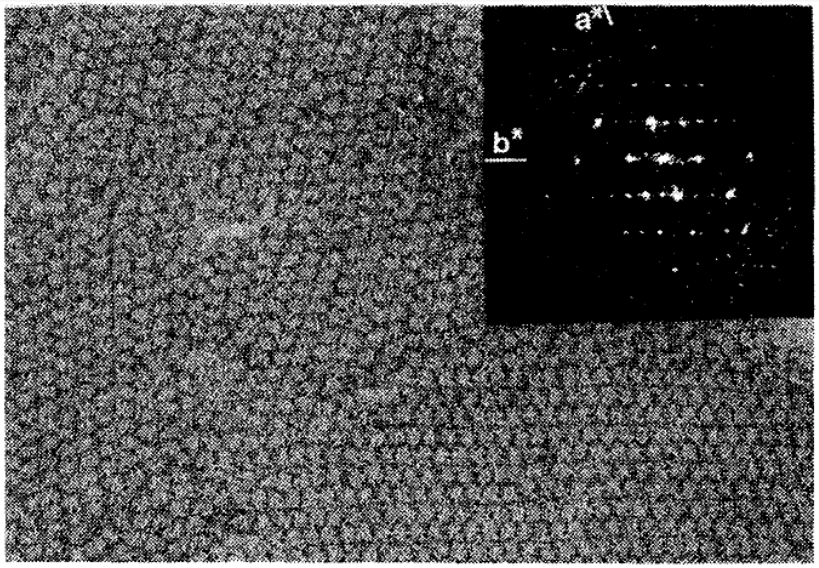

Fig. 1. A typical image of a salt-grown two-dimensional sheet stained by gold-thioglucose, and an optical diffraction pattern from a single crystalline domain containing about 20 × 10 unit cells. The a* and b* axes have been labeled. Areas for three-dimensional image reconstruction were chosen by using their optical diffractions according to the following criteria: (i) best resolution, (ii) patterns with sharpest reflections in patterns with no spurious spots, that is, including only one lattice region with the minimum mosaic spread.

Yonath. Leonard & Wittmann 1987

cantly to the resulting model, as shown in Fig. 5. Two-dimensional sheets were prepared as de-

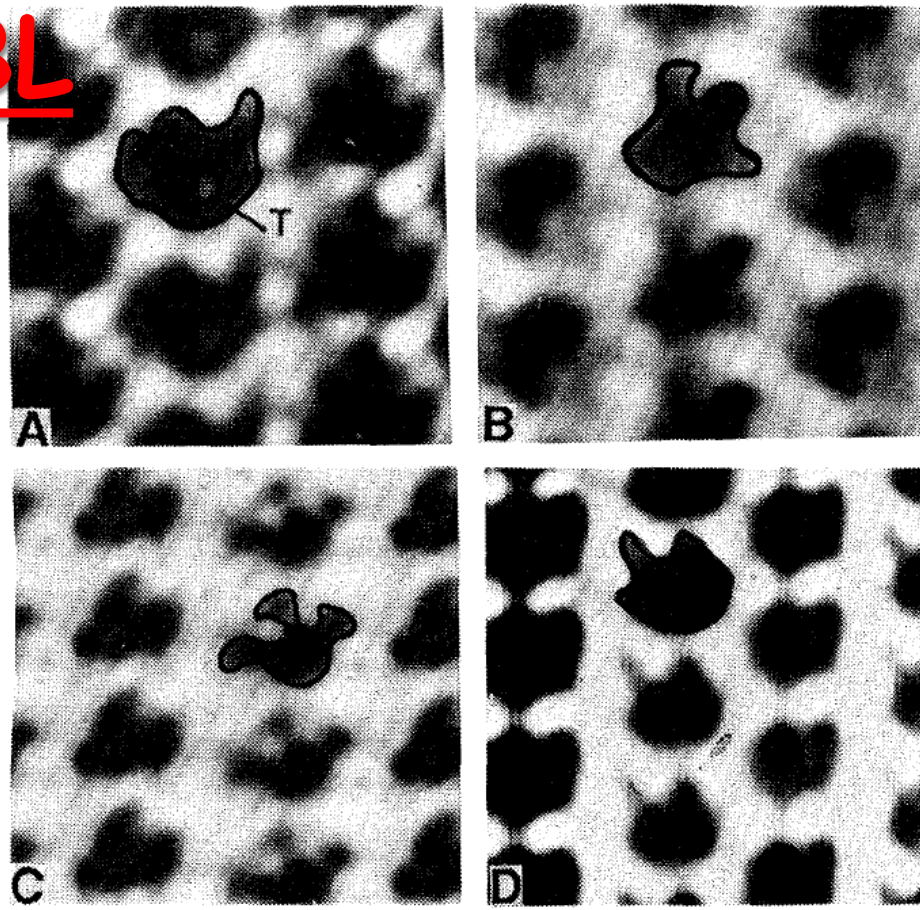

Fig. 4. Filtered images of electron micrographs i which the depicted view resembles that derive from electron microscopy of single particles. Th particles are black and the background is white (**A–C**) Filtered images of type (ST) sheets at 30° 20°, and 35° tilt angles, respectively. The tunne (T) can be seen. (**D**) Filtered image of type (AL sheets at a tilt angle of 25°.

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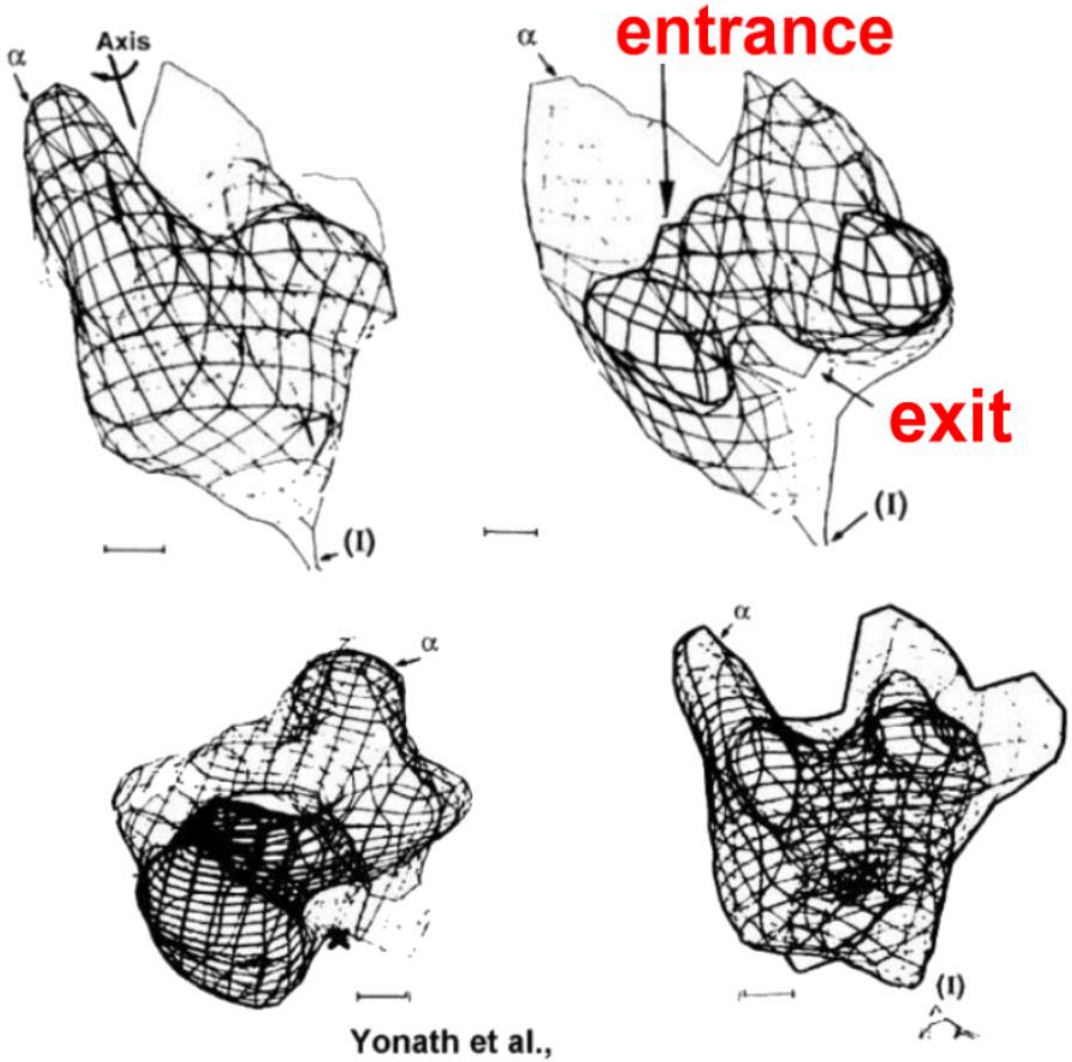

Yonath et al.,
Science 236, 813-816, 1987

814

Using three dimensional image reconstruction of tilt series of two-dimensioal sheets we* found that the PTC is situated above the entrance to an internal tunnel.

Based on previous biochemical studies,

Malkin & Rich, 1967
Blobel & Sabatini, 1970

we sugeted that this is the nascent protein exit tunnel.

The ribosomal tunnel – a rather controversial result, which 10 years later was rediscovered

NATURE VOL. 331 21 JANUARY 1988

REVIEW ARTICLE

The ribosome returns

Peter B. Moore

In the longer term, however, the need for high resolution information about ribosome structure is clear. The progress made by Yonath and collaborators in their crystallographic investigations in the past year is encouraging in this respect. They recently proposed a startling model for the 50S ribosomal subunit in which they postulate a large channel through the centre of the particle[30]. This model was based on a three-dimensional reconstruction from electron micrographs of crystalline sheets of ribosomal subunits from *Halobacterium marismortui*, a bacterium that lives only in saturated, or near-saturated salt solutions. It would be interesting to know whether this radial model is consistent with, for example, the solution-scattering data available for large subunits from *E. coli*. More significant than this model, however, is the fact that Yonath and co

In ribosome research Talmon has 7 papers, was first in 2 of them

1. Avila-Sakar, A.J., Guan, T.L., **Arad, T.**, Schmid, M.F., Loke, T.W., Yonath, A., Piefke, J., Franceschi F. and Chiu, W. (1994). Electron cryomicroscopy of Bacillus stearothermophilus 50S ribosomal subunits crystallized on phospholipid monolayers, J Mol Biol, 239, 689-97;
2. Eisenstein, M., Hardesty, B., Odom, O.W., Kudlicki, W., Kramer, G., **Arad, T.** Franceschi, F. and Yonath, A. (1994). Modeling and experimental study of the progression of nascent protein in ribosomes, In: "Supramolecular Structure and Function" (G. Pifat Ed) Balaban Pub, Rehovot, 4, 213- 46
3. 3. **Arad, T.**. Piefke, J., Gewitz, H.S., Romberg, B., Glotz, C., Muessig, J., Yonath, A. & Wittmann, H.G. (1987). The growth of ordered two-dimensional sheets of ribosomal particles from salt- alcohol mixtures, Anal Biochem, 167, 113-7;
4. 4. Glotz, C., Muessig, J., Gewitz, H.S., Makowski, I., **Arad, T.**, Yonath, A. and Wittmann, H.G. (1987). Three-dimensional crystals of ribosomes and their subunits from eu- and archaebacteria, Biochem Int, 15, 953-60;
5. 5. **Arad, T.**, Piefke, J., Weinstein, S., Gewitz, H.S., Yonath, A. and Wittmann, H.G. (1987). Three- dimensional image reconstruction from ordered arrays of 70S ribosomes, Biochimie, 69, 1001-6. 6
6. Shoham, M., Muessig, J., Shevack, A., **Arad, T**., Wittmann H.G. and Yonath, A. (1986). A new crystal form of large ribosomal subunits from Halobacterium marismortui, FEBS Lett, 208, 321-4
7. **Arad, T.**, Leonard, K., Wittmann, H.G. and A. Yonath, 1984. Two-dimensional crystalline sheets of Bacillus stearothermophilus 50S ribosomal particles, EMBO J, 3, 127-31

2 – משמאל - גביש של יחידת המשנה הגדולה של הריבוזום. מימין חתך של הגביש הנראה משמאל בכוון אקראי, צבוע נגטיבית

3- גידול גבישים דו ממדיים (חד שכבתיים) ישירות על גריד מיקרוסקופי הפוך כדי למנוע החליקתם. השיטה פותחה על ידי פיפקה וטלמון

4-מבנים של הגבישים החד שכבתיים. משמאל – לפני "ניקוי" ועם הדיפרקציה של קרן האלקטרונים. מימין – המבנים לאחר "טיפול" מתמטי (ניקוי)

5- סבוב (+_60 מעלות) של הדגמים מתמונה 4 הביא לגילוי המנהרה שבתוך הריבוזום, שדרכה עובר החלבון הנוצר בריבוזום מנקודת היווצרותו עד יציאתו לחלל התא

6- גילוי המנהרה היה לא צפוי, ועל כן גרם לתגובות שליליות, חלקן אפילו פורסמו על ידי "גדולי הדור". היא "גולתה" מחדש למעלה מעשר שנים על ידי מיקרוסקופיה בטמפרטורות נמוכות וכן כשפוענח מבנה הריבוזום