SUPPLEMENTARY MATERIALS

The supplementary materials (figures and tables) are provided below and as an independent file (PDF), along with their corresponding legend directly below the figure.

Figures S1 to S5

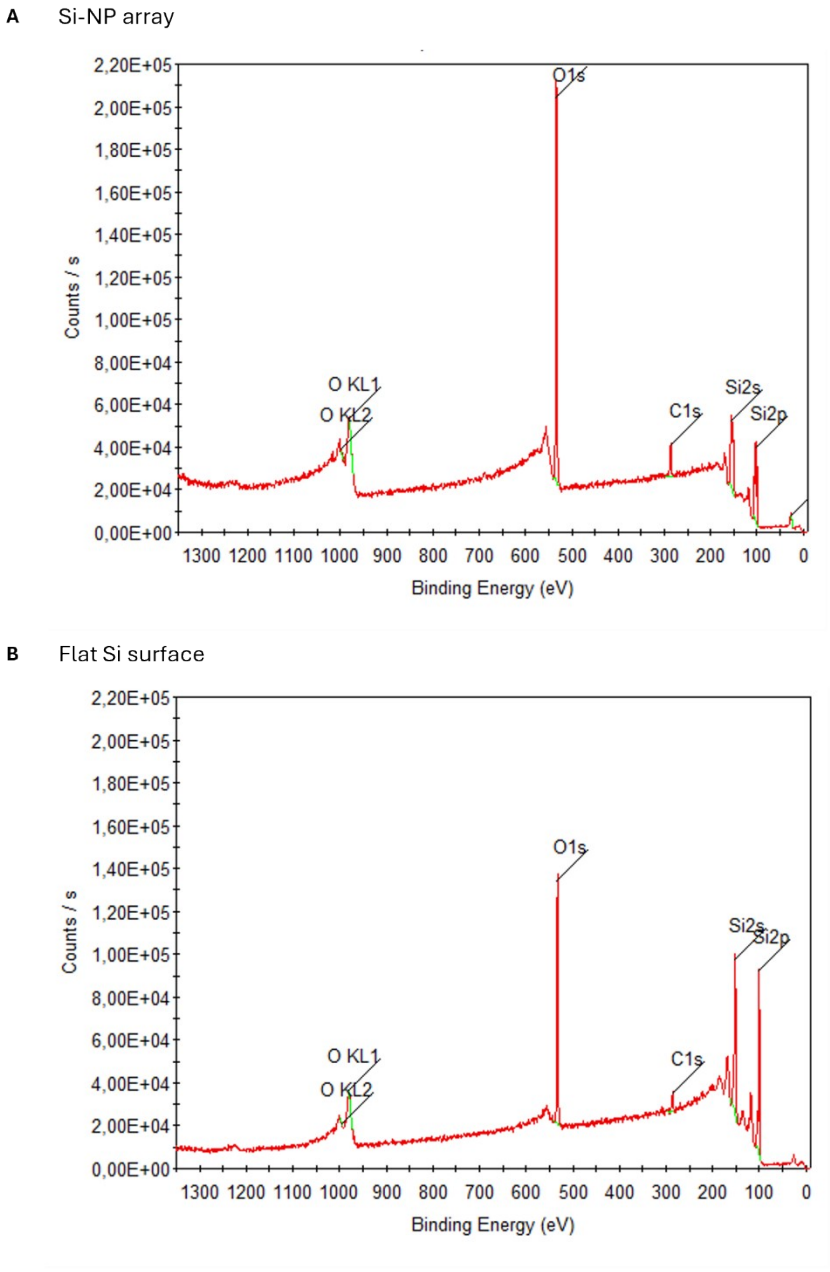

Fig. S1. X-ray photoelectron spectroscopy (XPS) graphs showing chemical composition of Si-NP array (A) and flat Si surface (B) wafers. The peaks are identified as silicon (Si), oxygen (O) and carbon (C).

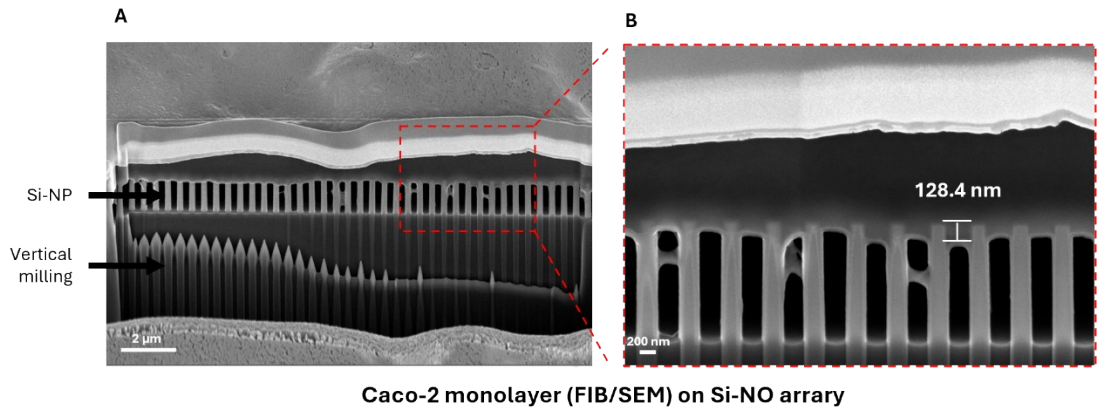

Fig. S2. Adhesion of human colorectal cancer cells (Caco-2) monolayer on Si-NP arrays. Representative focused ion beam-scanning electron microscopy (FIB-SEM) image of Caco-2 cells cultured on Si-NP for an extended time (72 h) when a cell monolayer is formed (A). Cross-sectional view highlighting homogeneous short-range vertical envelope at a depth of approximately 130 nm (B).

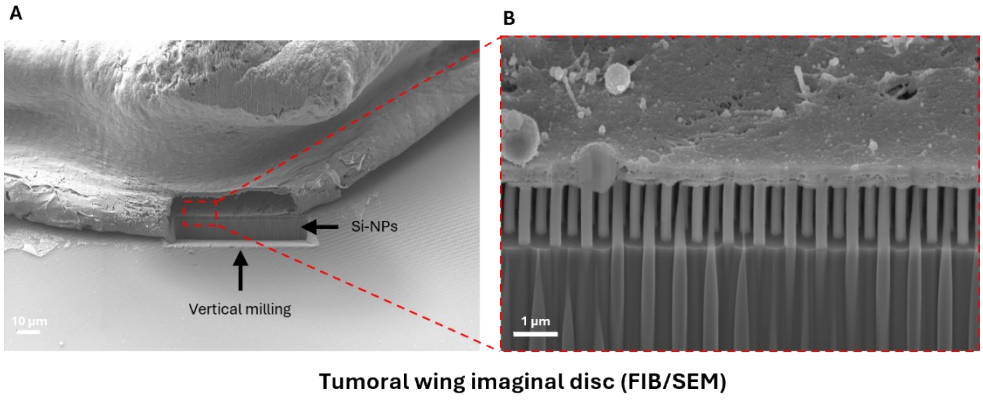

Fig. S3. Adhesion of *Drosophila* tumoral wing imaginal disc on Si-NP arrays. Representative focused ion beam-scanning electron microscopy (FIB-SEM) image of adherent tumoral wing imaginal disc (A) provides cross-sectional view (B) highlighting tissue intercalation between nanopillars.

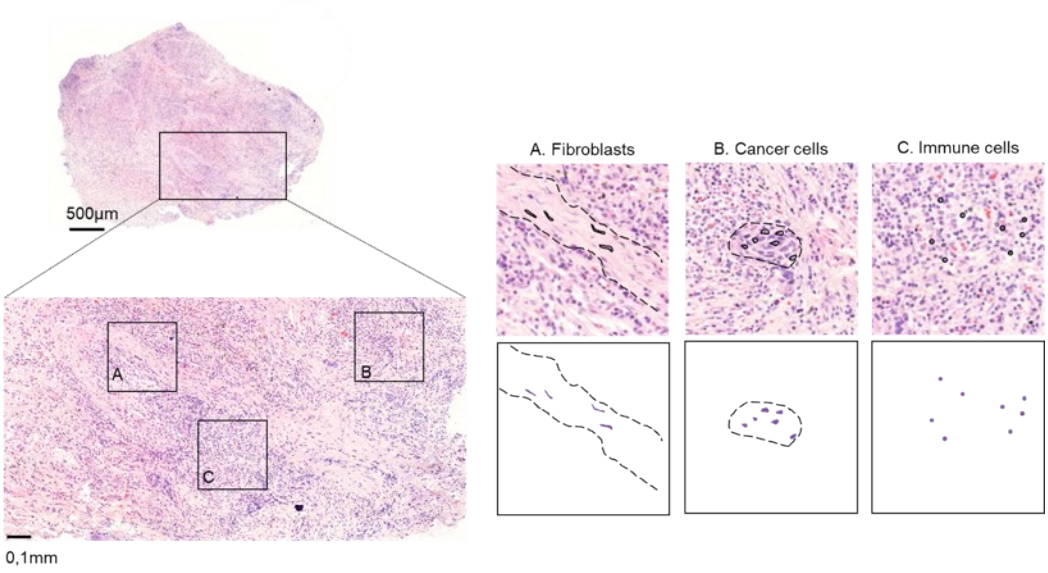

Fig. S4. Biocompatibility of patient-derived lung tumor biopsies *ex vivo* on Transwell inserts. Representative histological images of tumor sections cultured under pre-optimized conditions in transwell inserts (Control), stained for Hematoxylin & Eosin (HE) to assess cell density and morphology. High-magnification imaging shows numerous cell types: fibroblasts (A), cancer cells (B) and immune cells (C).

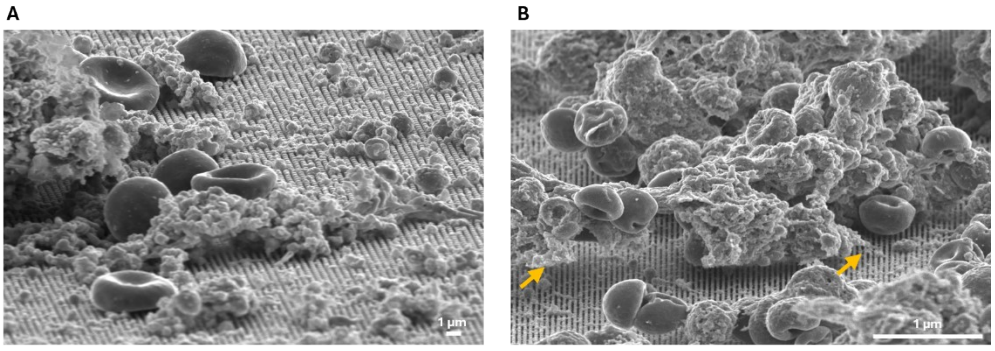

Fig. S5. Adhesion of non-tumor biopsies on Si-NP arrays. Representative scanning electron microscopy (SEM) image of non-tumor biopsies cultured on Si-NP array (A-B). High-magnification imaging shows few and short filopodia-like structures formed by non-tumor cells on Si-NP arrays (B, yellow arrows).

Table S1: Summary of patient's clinical data

Patient reference	Age (y.o.)	Gender	Histology	Race	Stage (*)	Biopsy sampling location
PEX01	67	F	ADC	Caucasian	IIB	Tumor core
PEX02	63	M	SCC	Caucasian	IIA	Tumor core
PEX03	59	M	ADC	Caucasian	IIB	Tumor core
PEX04	63	M	ADC	Caucasian	IIA	Tumor core
PEX05	61	M	ADC	Caucasian	IIIA	Tumor core
PEX06	62	M	SCC	Caucasian	IIIA	Tumor core
PEX07	74	F	SCC	Caucasian	IA3	Tumor core
PEX08	58	F	ADC	Caucasian	IIB	Tumor core
PEX09	60	M	SCC	Caucasian	IIIA	Tumor core
PEX10	77	M	SCC	Caucasian	IIB	Tumor core
PEX11	53	M	ADC	Caucasian	IA3	Tumor core

M: male; F: female; ADC: lung adenocarcinoma; SCC: lung squamous cell carcinoma,
(*) stage based on the AJCC 8th edition