pol I, и с рибосомными генами (Fomproix, Percipalle, 2004; Philimonenko et al., 2004). В течение последних двух десятилетий не осталось сомнений в том, что не только актин, но и миозин можно считать полноправным транскрипционным фактором (Grummt, 2006). При этом транскрипционная активность pol I зависит не только от связывания с G-актином, но и от его полимеризации (Ye et al., 2008).

Наконец, ядерный актин необходим для транскрипции генов, кодирующих U6 малую ядерную РНК (U6 snРНК) сплайсосом (Hu et al., 2004), синтезируемую pol III. Показано, что pol III ассоциирует с β-актином, который локализуется на активном промоторе гена *RNU6-1*, кодирующего U6 snРНК человека, который транскрибируется pol III. При изоляции pol III, очищенной от актина, она становилась транскрипционно неактивной, однако добавление β-актина восстанавливало ее транскрипционную активность *in vitro*.

ЗАКЛЮЧЕНИЕ И ПЕРСПЕКТИВЫ

Прогресс, достигнутый в исследованиях ядерного актина, несомненен. В далеком прошлом остались сомнения не только относительно его присутствия в ядре, но и возможности формирования ядерного F-актина. К настоящему времени доказано участие актина в регуляции всех основных ядерных процессов; в данном обзоре автор кратко остановился лишь на некоторых аспектах, связанных с поддержанием работы транскрипционного аппарата. Исследования ядерного актина дают множество ценных, а иногда неожиданных сведений не только о функционировании ядра, но даже об эволюции эукариот (Bajusz et al., 2018; Szabó et al., 2025). Результаты таких исследований, очевидно, будут полезны для понимания этиологии различных заболеваний человека — не только синдрома Вискотта–Олдрича, упомянутого в обзоре, но и, например, онкологических (Zahler, 2020).

Актин — полифункциональный белок, присутствующий в ядре и цитоплазме всех клеток, и в настоящее время одной из актуальных задач является понимание того, в чем специфика структуры и функций его цитоплазматических и ядерных форм. Дальнейшее развитие, очевидно, получат способы сверхточной прижизненной визуализации ядерного актина, в том числе F-актина, основанные на молекулярно-генетических методах. Весьма перспективным и актуальным на сегодняшний день является понимание роли (ролей) ядерного F-актина в интеграции многоступенчатых процессов, связанных с экспрессией генов. Несомненно, что в процессах формирования ядерных актинсодержащих белковых ансамблей еще предстоит оценить роль фазового разделения внутренне неупорядоченных белков (LLPS), среди которых известно множество актинсвязывающих белков, вступающих с актином в тесные функциональные отношения и влияющие на его полимеризацию. Это приблизит нас к лучшему пониманию основ формирования сложной трехмерной архитектоники ядра в целом и трехмерной структуры хроматина в частности. В любом случае раскрытие тонких деталей функционирования ядерного актина является масштабной задачей будущих исследований.

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